PECOS RIVER PROJECT

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HEARING

BEFORE THE

SUBCOMMITTEE ON IRRIGATION AND RECLAMATION

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS UNITED STATES SENATE

EIGHTY-FOURTH CONGRESS

SECOND SESSION

ON

S. J. Res. 155

TO PROVIDE FOR THE CONSTRUCTION OF CERTAIN WATER CONSERVATION PROJECTS FOR IRRIGATION PURPOSES IN THE PECOS RIVER BASIN, NEW MEXICO AND TEXAS

MAY 10, 1956

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PECOS RIVER PROJECT

THURSDAY, MAY 10, 1956

UNITED STATES SENATE,
SUBCOMMITTEE ON IRRIGATION AND RECLAMATION OF THE
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The subcommittee met, pursuant to call, at 10 a. m., in room 224, Senate Office Building, Senator Clinton P. Anderson, New Mexico, chairman of the subcommittee, presiding.

Present: Senators Clinton P. Anderson, New Mexico, and William R. Laird III, West Virginia.

Senator ANDERSON. The committee will be in order.

The first thing we will do is put into the record a copy of Senate Joint Resolution 155, to provide for the construction of certain water conservation projects for irrigation purposes in the Pecos River Basin, N. Mex. and Tex.

(S. J. Res. 155 follows:)

[S. J. Res. 155, 84th Cong., 2d sess.]

JOINT RESOLUTION To provide for the construction of certain water conservation projects for irrigation purposes in the Pecos River Basin, New Mexico and Texas

Whereas there has been an inadequate supply of water for beneficial consumptive uses in the Pecos River Basin, New Mexico and Texas, for a number of years; and

Whereas in recent years the shortage of water for beneficial consumptive uses in such basin has been aggravated by reason of the nonbeneficial consumptive use of water by salt cedars in such basin and by reason of the infiltration of brine into such river; and

Whereas the States of New Mexico and Texas, with the consent of Congress, entered into a compact in 1948 with respect to the Pecos River and one of the principal purposes of such compact was to provide for cooperation between the Federal Government and the States of New Mexico and Texas in studies and projects designed to make available a greater supply of water for beneficial consumptive uses in such basin; and

Whereas the Bureau of Reclamation and the Geological Survey, after investigation of certain conditions causing the shortage of water in the Pecos River Basin, have made reports in which they have respectively recommended, for the purpose of alleviating such shortage, the construction of a water salvage channel in such basin and the construction of works for the alleviation of salinity in such basin; and

Whereas the construction of such channel and works are estimated to cost $2,161,000 and $150,000, respectively, and the annual operation and maintenance costs for such channel and such works are estimated to be $52,800 and $4,300 a year, respectively; and

Whereas the States of New Mexico and Texas are ready and willing to make substantial contributions to the cost of construction of such channel and works if the United States Government will join with them in bearing such costs; and

Whereas State and local agencies in New Mexico and Texas are ready and willing to undertake equitably the financial burden of operating and maintaining such channel and works, and State and local agencies of Texas are ready and willing to undertake the financial burden of operating and maintaining the works for the alleviation of salinity in the Pecos River; and

Whereas the value of benefits which will accrue to the United States from the construction of such channel and works, including restoration of the ability of water users in such basin to pay their contractual obligation of approximately $3,500,000 to the United States, are substantially in excess of the share of the costs of construction of such channel and works to be borne by the United States: Now, therefore, be it

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Interior, acting through the Bureau of Reclamation, is authorized to construct upon a nonreimbursable basis, a one thousand five hundred cubic feet per second water salvage channel with spur drains sufficient to drain McMillan Delta in the Pecos basin in New Mexico in accordance with the plans set forth in the report entitled "Plan for McMillan Delta Water Salvage Channel, Pecos River Basin, New Mexico", prepared by the Bureau of Reclamation, approved by the Secretary of the Interior, and dated November 1954: *Provided, however*, That no money shall be appropriated for and no work commenced on the clearing of the floodway called for in said report unless provisions shall have been made to replace any Carlsbad Irrigation District terminal storage which might be lost by the clearing of the floodway. The Secretary shall not proceed with the construction of such channel until (1) he has adequate assurance from the State of New Mexico that it will, as it share of the costs of construction of such channel, acquire rights-of-way, complete such highway changes, and construct such bridges, as may be necessitated by the construction of such channel and that it will build an access road to such channel, and (2) he has adequate assurance from the Pecos River Commission or other State and local agencies in New Mexico and Texas that such commission or agencies in New Mexico and Texas will defray equally the costs of operation and maintenance of such channel.

SEC. 2. The Secretary of the Interior, acting through the Bureau of Reclamation, is authorized to construct upon a nonreimbursable basis, works for the alleviation of salinity in the Pecos River Basin, New Mexico, in accordance with the report entitled "Possible Improvement of Quality of Water of the Pecos River by Diversion of Brine, Malaga Bend, Eddy County, New Mexico", prepared by the Water Resources Division, Geological Survey, and dated December 1954. The Secretary shall not proceed with the construction of such works until (1) he has adequate assurance from the State of New Mexico that it will, as its share of the costs of construction of such works, acquire such rights-of-way for wells, pipelines, and disposal areas as may be necessitated by the construction of such works, and (2) he has adequate assurances from the Pecos River Commission or other State and local agencies in Texas that Texas or local agencies therein will defray the costs of operation and maintenance of such works.

SEC. 3. The projects constructed under the authority of this Act shall, except as otherwise provided herein, be governed by the Federal reclamation laws (Act, June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto), to which laws this Act shall be a supplement.

SEC. 4. Nothing contained in this Act shall be construed to abrogate, amend, modify, or be in conflict with any provisions of the Pecos River Compact.

SEC. 5. There are hereby authorized to be appropriated, out of any moneys in the Treasury not otherwise appropriated, such sums as may be required to carry out the purpose of this Act.

Senator ANDERSON. Is there a report from the Department?

Mr. LINEWEAVER. That is not yet available.

Senator ANDERSON. It is not yet available. If it comes before the time that the hearings are printed it will be made available and put into the record.

(The report referred to is not available.)

Senator ANDERSON. We have before us for consideration today Senate Joint Resolution 155, which provides for the construction of two water conservation projects for irrigation purposes in the Pecos River Basin in New Mexico and Texas. The projects are both located in New Mexico and are known as the McMillan Delta Water Salvage Channel and the diversion of Brine, Malaga Bend, Eddy County, N. Mex.

The Pecos River drains a large area of the high plains and a small mountain area. Its runoff, except for a small contribution from mountain snows and a low sustained base flow from artesian sources, is subject to the vagaries of flash floods which sometimes reach major magnitude.

Agriculture in the States of New Mexico and Texas, dependent for irrigation upon Pecos River water supplies, has been able to maintain itself under these rather uncertain runoff conditions only by the development of storage. Encroachment on storage space by sedimentation, depletion of the water supply by an expanding development of ground-water irrigation, and increasing natural losses due to spreading growths of salt cedars on the reservoir deltas have engendered disputes not only between the two States, but between competing water users within the States. The Carlsbad project of the Bureau of Reclamation, possessing one of the oldest water rights on the river, has suffered because of these water shortages and of course would be vitally affected by any upstream project.

Realizing the importance of cooperation between States on interstate streams for the purpose of equitably dividing the waters and putting them to their best use, the States of New Mexico and Texas back in the year 1925 signed the first Pecos River compact. It was ratified by both State legislatures, but was vetoed by the New Mexico Governor. In 1933 it was reconsidered by the New Mexico Legislature and ratified subject to certain amendments. However, it was not until after numerous meetings between the representatives of the States and much effort had been expended during the succeeding 15 years that compact was finally agreed to. The Pecos River compact was finally signed at a meeting in Santa Fe, N. Mex., December 3, 1948. By Public Law 91, the 81st Congress gave its consent to the agreement. Title 1 of the compact set forth the purpose as follows:

> The major purposes of this compact are to provide for the equitable division and apportionment of the waters of the Pecos River; to promote interstate comity; to remove causes of present and future controversies; to make secure and protect present development within the States; to facilitate the construction of works for (*a*) the salvage of water, (*b*) the more efficient use of water, and (*c*) the protection of life and property from floods.

We are now witnessing some progress by Texas and New Mexico in working out the water problems of their respective communities along the Pecos River. I believe our continued cooperation will ultimately result in the putting to beneficial use of many acre-feet of water heretofore totally lost.

There is no doubt about the need for the works proposed in this bill. We have seen the precious water spread out into the salt cedars between Artesia and Carlsbad and being soaked up for a loss of about 46,000 acre-feet per year. We had the same kind of problem on the Rio Grande below Socorro, N. Mex. In order to demonstrate what a project of this kind can do in salvaging water, I hope that during the hearing we can get something in the record regarding the success of that Rio Grande channelization project.

Texas, New Mexico, and the Federal Government will each share in the benefits derived from these projects. Therefore, it will be important that we get into the record testimony showing that each beneficiary is willing and able to contribute its share in the construction of these projects and the manner in which their contribution will be made.

Many times the question arises when such projects as this are being discussed as to whether or not there is sufficient interest or benefit to the Federal Government to justify its undertaking the project. There is some Federal land in the McMillian Delta which would place some obligation on the Government. The Federal Government will also benefit from the increased ability of the farmers to repay present indebtedness. I want to make sure these points are adequately covered in the record of testimony.

One of the things the people of the Carlsbad Irrigation District are most concerned about is replacement storage in Lake McMillan. Before the bill was introduced I wanted to make sure that there was agreement with the district on language in the bill that would satisfy them. I believe the bill as introduced adequately safeguards the district's interest, but I want to have that made clear in the testimony.

I have made the foregoing remarks as a matter of background for the testimony that is to follow. If the witnesses are ready, we will proceed with the first one.

The first statement will be that of the distinguished majority leader and senior Senator from Texas, Senator Lyndon Johnson.

STATEMENT OF HON. LYNDON B. JOHNSON, UNITED STATES SENATOR FROM THE STATE OF TEXAS

Senator JOHNSON. Mr. Chairman, you give me a chance today to support a program that will bring great and lasting benefits to the people of west Texas and New Mexico. It is a program which has been developed by a joint commission representing the two States and the Federal Government, a program which the Department of the Interior approves, and a program which the United States can afford.

So it is with an absolutely clear conscience, and with the conviction that the project deserves your approval as well, that I appear before this distinguished committee.

We address ourselves to what is perhaps the greatest problem in our American Southwest—water. But for the lack of water, our Southwest agriculture would be in an infinitely sounder condition than it is.

In some areas farmers are trying to survive in Dust Bowl situations. Many of them have given up. In much of the western area we will talk about, the land lies idle and deserted, for lack of irrigation.

At one time farms in this western area were quite productive, growing fruit and vegetable crops and forage for livestock. As the water supply dwindled and the quality of crops deteriorated, the area coverted to cotton and alfalfa, or, in some places, turned to barren dust.

On the Pecos River between New Mexico and the Rio Grande there is a master irrigation district. It contains almost 140,000 water-right acres. But under the conditions of the past 20 years, only about 34,000 acres has actually been irrigated. And most of the wells drilled in the area do not produce water suitable for irrigation.

The Pecos River, then, is the source of well-being or failure for these farmers.

Now, we have come here to discuss two problems which reduce the irrigating capacity of the Pecos far below what it should be.

The first of these problems occurs above Lake McMillan, in New Mexico, The delta about the lake extends over 13,000 acres; 10,000 acres of that is salt cedar. These trees "swallow" the Pecos at the rate of 40,000 acre-feet annually. When a flood comes down the river, only about a third of its water ever reaches the lake. The rest is poured down the roots of useless cedar trees.

This is a problem of volume—and its meaning for my State is that only a fraction of the land which could be irrigated in the lower basin receives any water at all.

The second problem lies above Red Bluff Reservoir, at Malaga Bend. Every day 380 tons of pure salt enter the Pecos at Malaga Bend. The Pecos, because it was formed by what the geologists call dissolution, rather than erosion, has a high mineral content in itself. Malaga Bend so increases the contamination that the water is sometimes too dangerous to use in irrigation.

In 1953 the water in Red Bluff Reservoir was so salty that the engineers let it all go downstream without diverting it to any irrigation use.

That is a problem of quality—and not just between good and better irrigation waters, but between usable water and waste. It can mean, in my State, a harvest of dust.

The plan before this esteemed committee today takes a long step toward solving these problems. The first part of the plan is the creation of a cleared floodway through the salt cedars. The estimate is that we can save 24,000 acre-feet of water from the cedars each year.

The second part of the plan is the construction of pumps and wells at Malaga Bend, to divert the salt springs away from the river.

The floodway cost is $2,161,000. The Malaga Bend wells will cost $150,000. The States of Texas and New Mexico will defray the maintenance costs of the projects, and provide rights-of-way.

The plan proposed goes, I think, straight to the heart of these problems. Admittedly the floodway and wells are not the final answer to the perfect irrigation of Pecos River lands. Admittedly the Pecos will not be turned into a Garden of Eden overnight.

But at a Federal cost of $2,311,000 we can provide for a tremendous increase in the water available for the Pecos Valley. And we can make sure that it is usable water.

America is not served by desolate farmlands. The economy of our country and the welfare of our citizens demand that our Government provide assistance in these areas of extreme need, when that assistance is practical and economical.

We have that responsibility upon us to a high degree in the Congress. We can answer to our responsibility in the Pecos Valley by approving the plan I have discussed today.

Gentlemen, I thank you for your courtesy.

Senator ANDERSON. Thank you very much.

I am very glad to have the presence of the junior Senator from Texas, with whom I have the pleasure of working on some water projects. Senator Daniel.

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STATEMENT OF HON. PRICE DANIEL, UNITED STATES SENATOR FROM THE STATE OF TEXAS

Senator DANIEL. Thank you, Mr. Chairman. I have enjoyed working with you and I am pleased to be a cosponsor of this bill with the distinguished senior Senator from Texas, Senator Lyndon Johnson. I have personally gone over this Texas Valley in days gone by and looked at all the problems. As the attorney general of Texas, I have helped in drafting the final Pecos compact which was approved in 1948. Therefore, I am very pleased to be recommending approval of Senate Joint Resolution 155, authorizing a water salvage plan and salinity alleviation program for the Pecos River.

This proposal is the result of detailed studies by the Pecos River Commission working in cooperation with the Bureau of Reclamation, the United States Geological Survey, and the local irrigation and water control districts in Texas and New Mexico. Since representatives of the Commission and other interested agencies will testify on details of the projects, my statement will be confined to a general review of the problems involved and the remedies suggested for solving them.

Briefly stated, the Pecos River Basin has suffered for many years from an inadequate water supply and the poor quality of the water that is available. Now the situation has become such that, if both or either of these conditions are permitted to continue unchecked, it will eventually mean the abandonment of lands now irrigated and the consequent financial ruin of water users and those dependent on them for a livelihood.

In that connection, I might add that out of 138,000 acres of land that could be irrigated in the Red Bluff District of Texas, only 6,000 acres are being irrigated this year because of these two problems.

Deterioration of the river channel and the encroachment of salt cedars above McMillan Reservoir in New Mexico has aggravated the already serious problem of an inadequate water supply. Water lost through evaporation, percolation, and the ever-increasing growth of nonbeneficial, high-rate water-consuming vegetation has been estimated at 46,000 acre-feet per year, resulting in only a small percentage of the normal river flow reaching the irrigated areas. Construction of the proposed water salvage channel, with spur drains sufficient to drain McMillian Delta, is therefore imperative. Reliable estimates show that the value of water saved annually would amount to $938,000. Compared with a total cost of $130,000 per year, this indicates a benefit-to-cost ratio of 7.1 to 1.

Contributing to the poor quality of water available is the inflow of concentrated brine through seeps and springs along a 3-mile stretch in New Mexico, which pours 370 tons of pure salt into the river daily. During the drought of 1953, this condition reached the point where the water became unfit for irrigation and actually killed the crops which had been planted. Under the salinity alleviation program devised by the Pecos River Commission and the Geological Survey—the first of its kind in the United States—it is estimated that approximately 75 percent of this salt contribution would be eliminated. This would result in substantial improvement in the quality of water used for irrigation of the 46,000 acres in the Red Bluff Water Power Control District in Texas.

State agencies of Texas and New Mexico in conjunction with local interests will bear the maintenance and operation cost of the two projects and will provide rights-of-way, highway relocations, access roads, and new bridges. In view of the better than 7 to 1 benefits-to-cost ratio established for the water-salvage plan and the experimental nature of the salinity-alleviation program, I hope this committee and the Congress will authorize the construction of these two projects.

Thank you, Senator Daniel.

Congressman Fernandez had hoped to be here. I think he is tied up in a hearing. Do you have a statement you would like to make for him?

Mr. ROBERT C. MCCONNELL (administrative assistant to Representative Antonio M. Fernandez, New Mexico). No, sir. I would like to say that the House committee is holding a hearing on the same authorization bill and Mr. Fernandez is over there in that committee because the House is meeting at 11 this morning. I think the Chair will know of our tremendous interest in the bill, but we have all these witnesses who traveled a thousand miles and we thought we would listen to their testimony in the interest of saving time.

Senator ANDERSON. Are there additional statements which should be put in from Members of Congress?

(No response.)

There is a fact sheet which I shall put in the record which summarizes the project in a very few words. I believe I will put that in the record at this point.

(The document referred to follows:)

PECOS RIVER BASIN PROJECT

FACT SHEET, SENATE JOINT RESOLUTION 155

Location.—Pecos River, New Mexico and Texas.

Problem.—Basin water supply complicated by decreasing inflow from tributaries; ground-water pumping resulting in depletion of 20,000 acre-feet annually; salt cedar growth and sediment accumulation, together with deterioration of quality of water for irrigation and domestic purposes.

Proposed construction.—Water salvage channel of 1,500 cubic feet per second capacity with spur drains, etc., and salinity-alleviation works.

Estimated costs.—Water salvage channel, $2,161,000; salinity works, $150,000. Annual operation and maintenance, $52,800 and $4,300, respectively.

Federal and State cooperation.—New Mexico and Texas to assume operation and maintenance costs of salvage channel; Texas and its local agencies to assume operation and maintenance of salinity works.

Reconstruction requirements.—Channel construction shall wait assurances from New Mexico as to right-of-way for channel and assurances from both States as to operation and maintenance. Provision must also be made to replace terminal storage of Carlsbad Irrigation District before appropriation of funds for floodway in connection with channel.

Federal appropriations.—Nonreimbursable.

Senator ANDERSON. Now we will start with Mr. Royce J. Tipton, chairman of the Engineering Advisory Committee for the Pecos River Commission. Mr. Tipton.

Mr. Tipton, you are no stranger to this committee.

STATEMENT OF ROYCE J. TIPTON, CONSULTING ENGINEER, DENVER, COLO., CHAIRMAN, ENGINEERING ADVISORY COMMITTEE, PECOS RIVER COMMISSION

Mr. TIPTON. Mr. Chairman and gentlemen of the committee, I have a written statement which I believe has been passed out. I shall not read the statement. It is quite long. There are quite a number of witnesses to appear here. As you know, some current hearings are going forward in the House, so I will make my oral statement as brief as possible and not take up the time of the committee.

My name is Royce J. Tipton, consulting engineer, from Denver, Colo. I have been connected with a study of the problems of the Pecos River for the past 20 years. Some 20 years ago the National Resources Planning Board became interested in the problems of the river and set up a joint investigation utilizing the services of all relevant Federal agencies. At that time I was a member of the consulting board that directed the investigation. One of the main objectives of the investigation was to gather facts to aid the two States, New Mexico and Texas, to negotiate a compact.

Very shortly after the investigation was completed, the 2 States did set up a compact commission, the 2 States, incidentally, a number of years before had attempted to consummate a compact. One was signed, but never did become effective.

Negotiations continued for several years after the last commission was set up. Finally the compact was signed in 1948 and consummated when it was approved by Congress in 1949. During that time I was chairman of the engineering advisory committee and after the commission was set up I have acted as chairman of that committee.

The Pecos River is a small river which rises in New Mexico and flows down through Texas and joins the Rio Grande. Although it is small, it has all of the problems that any big river ever had and has some problems peculiar unto itself. It has frequent droughts. It has floods. As has been stated here, the quality of the water always has been bad, and it is worse by conditions which have been mentioned which I will describe in somewhat more detail.

Development by the white man on the river started at a very early date. It started in Texas along about 1870 and in New Mexico even earlier than that. There is irrigated in the basin over 200,000 acres, of which about 150,000 are in New Mexico, 40,000 being irrigated by waters of the main stream. In Texas if the quality of the water was adequate and the quantity was adequate, there would be irrigated about 60,000 acres. There have been irrigated that amount.

The Carlsbad irrigation project started as a private enterprise in the latter part of the last century. There was constructed Lake McMillan Reservoir for the project in the early part of the present century, something over 50 years ago. The whole project was very severely damaged by floods in 1904. What was called then the reclamation service, which had just been created in 1902, took over the project. It rehabilitated Lake McMillan Reservoir which at that time had a capacity of 80,000 acre-feet. As time went on another very severe problem in the river began to affect adversely the Carlsbad project, and that is sedimentation. The river brings down a great deal of sediment, particularly during flood flows.

The capacity of Lake McMillan began to be deteriorated by sedimentation. That process went on at an alarming rate. The reservoir was raised twice, the dams were raised twice. A delta began to be built up above the reservoir.

Then along about1915 salt cedars began to come into the area and take root in the delta area. Nobody thought much about it at the time. The salt cedars began to spread and have been spreading the last number of years at an accelerated rate, a very alarming rate.

During the period of the last number of years those cedars have performed a very useful service for the area by straining out the silt and causing the silt to be deposited in the delta area, the delta area growing upstream.

The capacity of Lake McMillan has thereby been stabilized at some 35,000 acre-feet. It is slowly silting up, but not nearly so rapidly as it was before the cedars came into the picture.

But in payment for this useful service to man it has been taking a terrific toll of water.

There are attached to the statement which I submitted for the record some exhibits. Senator, those exhibits do not appear in the statements which have been circulated because we did not have enough of them. There is one exhibit in that statement called figure 1, which shows by years the increase in acreage of the salt cedars. In about 1912 it was zero. The growth went forward at a fairly uniform rate until about 1939, when there were about 13,000 acres. This chart represents only the area above Lake McMillan. By 1950 it was increased to some 33,000 acres. This chart, figure 1, which is in my statement submitted for the record, indicates a very rapid increase, and all of us who have been investigating the problem know that that is absolutely true.

There is attached to this statement of mine also maps showing the extent of increasing growth between 1940 and 1950. (These maps, figs. 4, 5, 6, not printed, and they are retained in the committee files.)

When the compact was negotiated the principle of the compact was that there should be certain deliveries made to Texas based upon inflow to the rived. The compact specifically provided New Mexico would not be charged with any increased depletion of the water supplies caused by nature, that it would be responsible for any increase by man over what we call 1947 conditions.

In my statement submitted for the record there appears figure 4, and on figure 4 is indicated a black curve showing the relationship between, what we call the index, inflow to the river and the outflow at the State line, under the so-called 1947 conditions, which relationship should be maintained insofar as man's activities are concerned.

On figure 2 there appears a series of red dots which lie below the black line. Those red dots indicate actual performance of the river since the compact went into effect. The difference between the position of the red dots and the black line indicates depletion of the State line outflow which has gone forward between 1948 and 1953, all of it because of increased growth of salt cedars.

The compact commission in negotiating the compact recognized fully the problems which confronted the river. The compact commission in drafting the compact obligated the commission to do something about it.

Senator ANDERSON. Excuse me. We have a point here I want to clear up. When you look at your testimony will you make sure that the comments you made with reference to these charts tie specifically into the printed chart which we will try to reproduce, because I would like to use these charts in the testimony.

Mr. TIPTON. For your information, it probably will have to be redrafted.

Mr. LINEWEAVER. They are in colors.

Mr. TIPTON. We will get together on that. (Charts, figs. 1, 2, 3, are printed; the maps, fig. 4, 5, 6, not printed. They are retained in the committee files.)

Senator ANDERSON. I think it is particularly important to get into the record the story of these salt cedars and what they have done to the water supply.

Mr. TIPTON. Article IV of the compact provides in part as follows:

> (a) New Mexico and Texas shall cooperate to support legislation for the authorization and construction projects to eliminate nonbeneficial consumption of water.
>
> (b) New Mexico and Texas shall cooperate with agencies of the United States to devise and effectuate means of alleviating the salinity conditions of the Pecos River.

The compact commission, after the compact became effective, immediately got busy under the directive of the compact. A permanent advisory committee was set up and has gone forward since that time with a very active investigation participated in by relevant Federal agencies. There has been wonderful cooperation between the commission, the engineering advisory committee, and those Federal agencies.

The ones who have contributed the most to the studies are the Bureau of Reclamation of the Department of the Interior, various branches of the United States Geological Survey, principally the ground water branch and the quality of water branch.

As a result of those efforts, the Commission developed a project and issued a report which will be submitted for the record by another witness entitled "Initial Development, Water Salvage and Salinity Alleviation Action Programs, Pecos River Basin," dated February 1955.

The Bureau of Reclamation studied the problem at the request of the Commission, and it has issued a report based upon the plans developed by the commission.

The plan that has been evolved for the salvage of water in the salt cedar area is a carrying channel to be constructed through the Delta area having a capacity of 1,500 second-feet. It extends from a point near Artesia which you see on the map, down to Lake McMillan. There had been proposed by the Bureau a number of years ago, in 1950, such a channel which would have skirted the delta area to the west. It would have been specifically constructed for the benefit of the Carlsbad Irrigation District in order to attract releases from Almagordo Reservoir which was constructed in 1956 partly as a replacement for Lake McMillan, to transmit that water down through the salt cedars.

The commission felt that while that project was excellent from the local standpoint, it did not have too much interstate importance.

So the channel of the present project would extend right up through the delta area. There would be also provided a floodway with a capacity of 400,000 second-feet, the floodway being formed by a levee constructed from the spoil from the carrying channel, and it would be cleared of cedars so the floods beyond the capacity of the 1,500 second-foot channel could pass on down unobstructed by the cedars.

Because of the fact that that would accelerate the sedimentation of Lake McMillan and because Lake McMillan is a very important terminal reservoir for the Carlsbad Irrigation District, the resolution which is before the committee specifically provides that no funds shall be expended on the clearing of the floodway until there has been found some means to provide the necessary terminus area for the Carlsbad Irrigation District.

So what you would be approving at the present time, you would be authorizing the entire project, but with the proviso that no funds be expended for the clearing of the floodway until the terminal storage was found.

The carrying channel itself as estimated will salvage about 80 percent of the amount of water that the entire project would salvage.

I want to refer to exhibit 7 (not available) in the Commission's report. This indicates what does happen to specific flows of water. These came from actual records. This is a diagrammatic chart indicating the volume of water passing certain stations on the river, gaging stations. This particular flow passes Lake Arthur. It is above the saltcedars. There was 21,004 acre-feet passed Lake Arthur during that particular flow. There is no intervening irrigation between this and the last point which I will refer to. Everything which has happened to this water has happened because of nature and because of the saltcedars.

A very short distance downstream we come to the Gagin station at Artesio, which is shown on the map, and that flow of 21,404 acre-feet has been diminished to 18,050 acre-feet. Those are actual measurements.

When we get down to what is called the Kaiser Channel, which is a channel which has been constructed part way up through the delta area by the Carlsbad Irrigation District in order that it might get its reservoir water down to the district, that original flow of 21,000 acre-feet had shrunk to 8,832 acre-feet.

It has been estimated that if this project had been in operation the original flow of 21,404 acre-feet when it got to Lake McMillan would have been 15,250 acre-feet, representing a salvage of something over 7,000 acre-feet out of that one flow.

In other words, a third of that flow was lost by the cedars and it would have been salvaged.

Senator ANDERSON. It would almost have doubled the net flows, which got down to 8,800 feet.

Mr. TIPTON. Yes, sir. There is a good deal of detail which could be gone into, which I am not going to do. There is in this report, exhibit 5 (not available), a picture of the saltcedars. There is a series of pictures which another witness will present which shows the flow of water progressively down through the cedar area, a picture taken from an airplane, quite graphic.

It is my firm conviction as an engineer who has studied this problem for 20 years that unless something is done the irrigation which de-

pends upon the water below the Lake McMillan will gradually go out of the picture. There is a segment of civilization there which depends on irrigation which will cease to exist. In my opinion that is inevitable.

The other acute problem with respect to the river is salinity. The water always was bad, and we cannot do anything about that, but we can do something about one specific problem. At Malaga Bend, which is near the State line, there is an artesian flow of water amounting to one-half second-foot coming to the river which is concentrated brine. Underlying the area is a sea of brine, and it is under artesian pressure. At this particular point the confining formation called the Rusler formation, has been so fractured that it permits that brine under artesian pressure to leak upward to the river. That one-half second-foot of water is bringing to the river 430 tons of salt per day. Of that solids, well over 300 tons is sodium chloride, which is very deleterious to irrigation water. For the last number of years we have had a drought period throughout the Southwest. It has been particularly bad on the Pecos. In a 3-year period such as 1951 through 1953 the flow at Artesia before you get to the saltcedars was only about 40 percent of the long-time average. The flow at the State line was about 19 percent of the long-time average. Nature has shut off the water but she has not shut off the salt. So this brine comes to the river, and the less water there is in the river for use below, the more concentrated it becomes.

That has had a very bad effect on the Texas area. The engineering advisory committee has estimated that under normal water conditions if the salinity problem could be alleviated by means which I will describe, there could be brought under cultivation 1,000 acres of land in Texas which have been temporarily abandoned. That is under normal conditions. That is aside from the salvage.

The committee, in cooperation with the United States Geological Survey, has advised a plan for alleviating this condition. Two wells will be constructed down into the brine. They will be pumped and the brine will be disposed of in a little closed basin where the water will be evaporated and the salt will be stacked. It is estimated that the capacity of the disposal area will be such that it will last many, many years. There are other disposal areas in the area. It is estimated that over 75 percent of the salt will be eliminated by that means. The pumping of the brine will take the artesian head off and will prevent the leakage of the brine to the river.

The salvage project, as has been stated, is estimated to cost $2,161,000, and the salinity alleviation project to cost $150,000. The States will cooperate, as has been mentioned, and other witnesses will indicate the extent to which they will. Personally, I very much hope that this committee will see fit to recommend the construction of these two projects, without which the area will gradually decline and disappear as far as irrigation is concerned. I very much hope that the Senate will enact a bill authorizing the project.

Senator ANDERSON. Mr. Tipton, does the resolution as it now stands represent about the best that we can get under the circumstances?

Mr. TIPTON. Yes, I am not sure, but I think possibly the Bureau may have some suggestion on it, but as far as I am concerned——

Senator ANDERSON. For example, we have said that the floodway may not be constructed at this time.

Mr. TIPTON. I think the bill is completely adequate. I would be glad to answer any questions.

Senator ANDERSON. Thank you very much.

(Mr. Tipton's prepared paper follows:)

STATEMENT OF R. J. TIPTON, DENVER COLO., CHAIRMAN, ENGINEERING ADVISORY COMMITTEE OF PECOS RIVER COMMISSION

My name is Royce J. Tipton, consulting engineer, with offices in Denver, Colo. I have been identified in an official capacity with the problems on the Pecos River since the late 1930's. At that time I was a member of a consulting board which directed a joint investigation conducted by the National Resources Planning Board, utilizing the services of all relevant agencies to investigate the problems of the Pecos River. One major objective of the investigation was to collect data and determine facts which would be of aid to the States of New Mexico and Texas in negotiating a compact covering the uses of the waters of the Pecos River.

Finally, after the investigation was completed, the States of New Mexico and Texas created a compact commission and, after a number of efforts, did negotiate a compact which was signed in Santa Fe, N. Mex., on December 3, 1948. It was ratified by the legislatures of the two States, and became effective when Congress gave consent to the compact by Public Law 91, 81st Congress.

During the last phases of the negotiation of the compact I was chairman of the engineering advisory committee which developed a report around which the compact was largely framed. After the compact became effective, I continued on as adviser to the commission and as chairman of the engineering advisory committee.

The Pecos River, while small compared with other rivers of the West, has most of the problems that confront any of the rivers of the West. These problems consist of recurring destructive flood flows, recurring drought periods, poor quality of water, sedimentation, and large nonbeneficial uses of water by natural water-loving plants such as saltcedars and salt grass. Nature has brought about conditions in certain reaches of the Pecos River which each year are depriving man of water from an already limited supply which he had been beneficially using. Of greatest import is the fact that these conditions are, year by year, becoming progressively more serious, and the end result could cause abandonment of lands which are now, or in the past have been, irrigated. If no action is taken to abate the relentless course of nature and certain other conditions, a very important and prosperous economy in the Pecos River Basin founded on irrigation could be gradually destroyed and the area ultimately be returned to its original desert state.

The following is quoted from the report of the engineering advisory committee to the Pecos River Compact Commission, dated January 14, 1948, prior to the consummation of the compact:

"Since white man has known the Pecos River conditions on it have never been static. They have been in a continual state of flux. Major problems in the river basin have caused continual efforts to be exerted in the past, and will cause continued efforts to be exerted in future in order to preserve existing irrigation development. Most of the remedial measures adopted in the past, and ones proposed at the present time, have interstate aspects. Some of the measures now needed cannot be effectuated until the interstate difficulties are adjusted."

Intrastate and interstate problems on the Pecos River are of long standing. McMillan Reservoir which was constructed for the benefit of the Carlsbad Irrigation District in New Mexico, having an original capacity of 80,000 acre-feet, has been depleted by sedimentation to a capacity of about 35,000 acre-feet, and this capacity is not fully usable because of excess leakage from the reservoir. As a result of the desire of the Texas interests to construct a reservoir near the State line to regulate the water for the existing Texas development, an investigation and report was made in 1914 by the United States Reclamation Service. Because of the interstate problems involved, a compact commission was appointed and a compact was negotiated and signed in 1925. This compact never became effective. In the meantime the Alamagordo Reservoir in New Mexico was constructed in 1937 to a capacity of 156,000 acre-feet, part of which was to replace the capacity lost in McMillan Reservoir. The reservoir was authorized for construction only after a so-called gentleman's agreement was reached between certain congressional delegations of the two States and

certain local interests with respect to the manner in which the reservoir would be operated. Incidentally this reservoir is now silting up at an estimated rate of 1,900 acre-feet per year, its present capacity being about 128,000 acre-feet. Finally at about the same time the Red Bluff Reservoir with a capacity of 270,000 acre-feet was constructed for the benefit of the Texas area.

Finally, a compact between New Mexico and Texas was successfully negotiated and signed in Santa, Fe, N. Mex., on December 3, 1948. The compact provided, in effect, that New Mexico would deliver to Texas the same amount of water that Texas was receiving under conditions which existed on the river in 1947 but that New Mexico would not be responsible for any increased depletion of the water supplies by acts of nature.

At least two conditions are adversely affecting water users in both New Mexico and Texas. If these conditions are not abated and corrected, both New Mexico and Texas can expect a segment of civilization in those States which depends upon the use of Pecos River water for irrigation largely to disappear.

As the capacity of Lake McMillan began to be depleted by sedimentation, saltcedars came into the area and began to take root in the delta progressively being formed by the sediment at the head of the reservoir. These cedars spread rapidly and performed a useful function for the Carlsbad Irrigation District. They effectively provided a strainer for the silty water coming down the river, thereby causing the silt to deposit in the delta area and to extend farther upstream, permitting only the fairly clear water to enter the reservoir. The capacity of the reservoir thereby was stabilized at about the present capacity of 35,000 acre-feet. However, in performing this useful function for man, the saltcedars took their toll in terms of consumption of large quantities of water. At the time the compact was negotiated the cedars covered an area on the McMillan Delta of some 12,000 to 15,000 acres. The engineering advisory committee, in its report cited above, estimated that these cedars were consuming about 55,000 acre-feet of water per year, a part of which would be recoverable by the construction and operation of the proper engineering works.

Another troublesome problem on the Pecos is the quality of water. Apparently the quality of Pecos River water never was good, the entire basin having been formed largely by dissolution rather than by erosion. Sink holes can be observed throughout the basin below the mountain area. The dissolution which is at present taking place can be observed at such locations as the Bottomless Lakes. Through the process of dissolution both the surface and ground-water supplies become contaminated with soluble salts. The use of water for irrigation has aggravated the problem. Superimposed on top of this already bad water are about 133,000 tons per year of practically pure salt which is being brought to the river in a 4-mile reach at Malaga Bend by leakage of concentrated brine which is under an artesian head. The engineering advisory committee in its original report estimated that, if this brine inflow could be eliminated, of the land temporarily abandoned in Texas about 1,000 acres could be brought back into cultivation.

To make matters worse, during the last few years a drought has existed on the Pecos. The average runoff at Artesia for the 3 years 1951 through 1953 was 43 percent of the longtime mean. At the State line the runoff for the same 3-year period was only 19 percent of the longtime mean. Unfortunately nature has turned off the water but has not turned off the salt.

When the Pecos River Compact Commission negotiated a compact, all of these matters were fully recognized. The following is quoted from article IV of the compact:

"(*a*) New Mexico and Texas shall cooperate to support legislation for the authorization and construction of projects to eliminate nonbeneficial consumption of water.

"(*b*) New Mexico and Texas shall cooperate with agencies of the United States to devise and effectuate means of alleviating the salinity conditions of the Pecos River."

These provisions indicate plainly that the commission had in mind at the time it negotiated the compact an action program to take care of these two situations to the extent possible.

I now want to discuss in more detail the extent of the growth of the natural water-loving plants, and the salinity problem in the vicinity of Malaga Bend. Records indicate that prior to 1915 there were no salt cedars in the Pecos River Basin. In that year they began to come into the Pecos Basin as well as into other river basins in the Southwest. On figure 1 is indicated the estimated acreage of salt cedars in the Pecos River Basin in New Mexico for various years.

It may be noted that in the year 1947 the area of salt cedars was about 27,000 acres. This year is significant because it is the conditions of 1947 around which the compact was framed. The commission caused to be made aerial pictures of the basin in 1951 and caused maps to be prepared from the aerial photographs which show the various types of cover on the irrigated area of the basin. Another aerial survey had been made of the basin in the fall of 1946, the results of which fairly well portray 1947 conditions.

The attached three maps (not printed, retained in committee files) show the extent to which the salt cedars and other water-loving plants have increased in area between the fall of 1946 and 1951. On these maps the shaded areas represent the zones within which water-loving plants existed in 1946, and the red areas indicate their spread between that time and 1951. The increase is essentially all above Lake McMillan and is on the west side of the river. Between the head of Lake McMillan and Alamogordo the increase amounts to about 6,000 acres. These 6,000 acres of new water-loving plants have a potential ability to consume between 24,000 and 30,000 acre-feet of water per year.

Figure 2 indicates, in my opinion, the effect of this increase in area of water-loving plants on the water supply of the basin. This figure is an enlarged portion of one of the inflow-outflow curves that is used by the commission to determine changes within the basin which might affect the outflow from the basin. The scale on the botton of the figure indicates what is known as the index inflow. This is made up of the flow past Alamogordo plus flood flows which reach the stream below Alamogordo. The scale on the left of the figure indicates the deliveries of the river to Texas near the New Mexico-Texas State line. The black line on the figure indicates the relation between the index inflow and the delivery to Texas under 1947 conditions, as determined from historical occurrences. By means of this chart and an analysis of the basic data for each year, the commission can determine whether conditions on the river are becoming worse and, if an action program is undertaken, it can determine the extent to which conditions are improved.

On the figure appears a series of red dots which indicate from unofficial calculations the actual relations between the index inflow and the outflow since the compact went into effect. It may be noted that those dots define a new curve lying to the right of the base curve, indicating that with a given inflow the river is delivering to Texas a lesser amount of water than it would have delivered under 1947 conditions. A part of this increased depletion in New Mexico may be manmade, but in my opinion much of it is because of the continued increase of the area of water-loving plants.

Referring again to figure 1, which shows the relation between years and the area of water-loving plants, it may be noted that the area of water-loving plants is increasing at an accelerated rate. Unless this natural cancerous growth is abated and much of it eliminated, nature soon will have taken over the river and deprived the irrigators of water which they have used for many years.

Through the engineering advisory committee to the commission, a number of Federal agencies have been cooperating on a study of this problem. These agencies include notably the United States Bureau of Reclamation and various branches of the United States Geological Survey. The Bureau of Reclamation over a period of years has conducted experiments with sprays of various types applied by plane to determine their effectiveness in killing the cedars. The Bureau also has cut "breches" through the cedars at about one-half mile intervals for the purpose of observation and determination of the density of the cedars, and the effectiveness of the kill from the application of the spray. Holes have been bored at certain intervals in the "breches" for the purpose of observing the ground-water levels. Samples of the delta soils have been taken in order to determine their characteristics, including their coefficient of transmissability.

At one time the Bureau of Reclamation proposed the construction of a bypass channel with a capacity of 1,500 second-feet. This channel would have diverted from the river at the head of the delta and would have skirted the delta and cedars to the west, bypassing Lake McMillan. The major objective of the channel would have been to transit Alamogordo releases and other water destined for the Carlsbad Irrigation District. The district itself has constructed a small channel known as the Kaiser Lake Channel through a part of the delta, leading into Lake McMillan.

While the Bureau of Reclamation's proposed channel would have been of considerable benefit to the Carlsbad Irrigation District, and while probably the Kaiser Lake Channel constructed by the district is doing some good, nevertheless in the opinion of the engineering advisory committee these benefits would have

been, and are, local in character and do not have too much interstate import. It is the opinion of the committee that some of the very large losses of water which take place in the morass of salt cedars are from flood flows which spread throughout the area making them subject to rapid transpiration by the cedars and to evaporation.

A series of 20 photographs (not available) were taken from the air during the fall of last year which show graphically how flows of the Pecos River have spread throughout the morass of salt cedars and have been trapped thereby, and subsequently transpired and evaporated. These photographs, together with explanations thereof, will be presented by another witness.

The Pecos River Commission's report entitled "Initial Development Water Salvage and Salinity Alleviation Action Programs, Pecos River Basin," dated February 1955, outlines in more detail the problems I am discussing. Exhibit No. 7 (not available) of that report shows graphically the diminution of water in the Pecos River throughout various of its reaches, largely because of the effect of salt cedars. This exhibit is quite typical of what happens along the river when flows exceed the channel capacity. It indicates, for example, that for the period May 18 to 26, 1954, some 21,404 acre-feet of water passed the gaging station at Lake Arthur. The water had been diminished in amount to 18,050 acre-feet when it passed the gaging station at Artesia, which is located at the head of the proposed development, 18 river miles below Lake Arthur. The volume of water had been diminished to 8,832 acre-feet by the time it reached the Kaiser Channel in the delta area. In other words, about 40 percent of the water that passed Lake Arthur reached the Kaiser Channel.

It is estimated that had the proposed salvage works been in operation, the inflow into Lake McMillan itself would have been 15,250 acre-feet out of the original 21,404 acre-feet, or about 7,000 acre-feet would have been salvaged from this one flow.

The engineering advisory committee believes that one rational remedy for this situation would be the construction of a major drainage and carriage channel at an appropriate location through the delta area. This channel should have sufficient capacity to transit, in addition to releases from Alamogordo Reservoir, all except unusual flood flows. The committee believes that the canalization above the delta of the river up to Alamogordo Reservoir also should be accomplished for the same purposes. Incident to the improvements in the delta area, it is the committee's opinion that a floodway should be provided by offset levees constructed from the required excavation from the drainage and carriage channel. This floodway should be maintained free of water-loving vegetation. Floods in excess of the capacity of the drainage and carriage channel would be carried in the flood channel between the two levees into Lake McMillan.

The United States Bureau of Reclamation cooperated with the commission and engineering advisory committee in making an investigation of the construction of a channel and the provision of a floodway through the delta area. The results of the Bureau's investigations appear in a report dated November 1954 entitled "Plan for McMillan Delta Water Salvage Channel, Pecos River Basin, N. Mex." (retained in committee files). The plan follows closely the recommendations of the engineering advisory committee. However, it is recognized by interested entities that, if the cleared floodway were provided at this time, the sedimentation of Lake McMillan would proceed at an accelerated rate. It has been agreed that, while the cleared floodway should be a part of the project, its actual clearing should be deferred until some means are devised to replace any Carlsbad Irrigation District terminal storage which might be lost by the clearing of the floodway.

Going now to the Malaga Bend salinity problem, the commission has had excellent cooperation from the Quality of Water and Ground Water Branches of the United States Geological Survey. The result of the work of these two branches to date would seem to indicate that the artesian head on the brine of the Malaga Bend area might be relieved by the construction of two wells and the pumping of a relatively small amount of the brine from the alluvium and the brine basin. It would be intended that this brine would be conducted to some disposal area where it would be evaporated, Queen's Lake being mentioned as probably the best available area for that purpose.

Figure 3 is a salinity profile indicating the accumulation of salt in tons per year with respect to distance through the Malaga Bend reach of the river for 1953.

The United States Geological Survey through its Ground Water Branch, in cooperation with other agencies of the Government, conducted a series of pump tests in the Malaga Bend area which disclosed that the salinity condition in this reach of area could be alleviated by the construction and operation of wells

and pumps in order to relieve the artesian head on the brine which is being brought to the area, and the conveyance of the brine pumped by the operating wells to a disposal area. The construction of the works to bring about a measure of salvage of water now being nonbeneficially consumed by salt cedars and other water-loving plants, and the provision of means to alleviate the salinity conditions in the Malaga Bend reach of the river is the subject of the bill which is before this committee. It is estimated that the channel required to bring about a measure of salvage of water would cost $2,161,000 and that the works to alleviate salinity conditions would cost $150,000. Annual operation and maintenance for the channel is estimated at $52,800 and of the salinity allevation works at $4,300.

Without an action program, natural water-loving plants are going to continue to propagate and increase nonbeneficial consumption of Pecos River water. Without an action program underground brine will continue to flow into the Pecos River in the Malaga Bend area. Inaction can only bring disaster.

It is my opinion that the proposed legislation before this committee is a step in the right direction to bring about the required action program. It is hoped that the committee will report favorably on the bill.

Figure 1

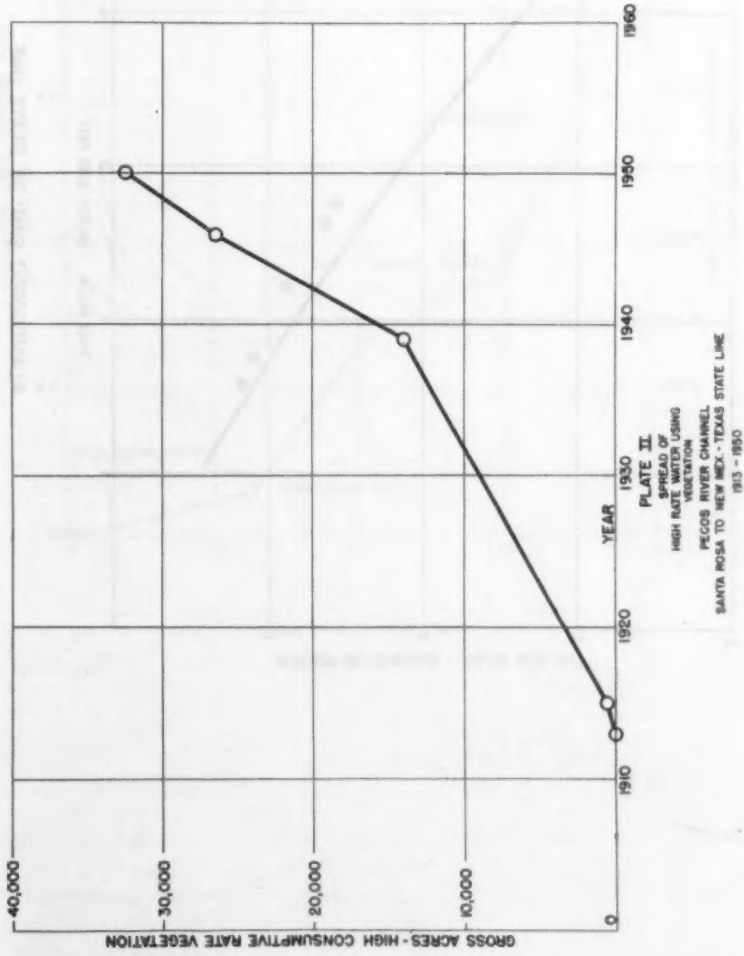


Figure 2

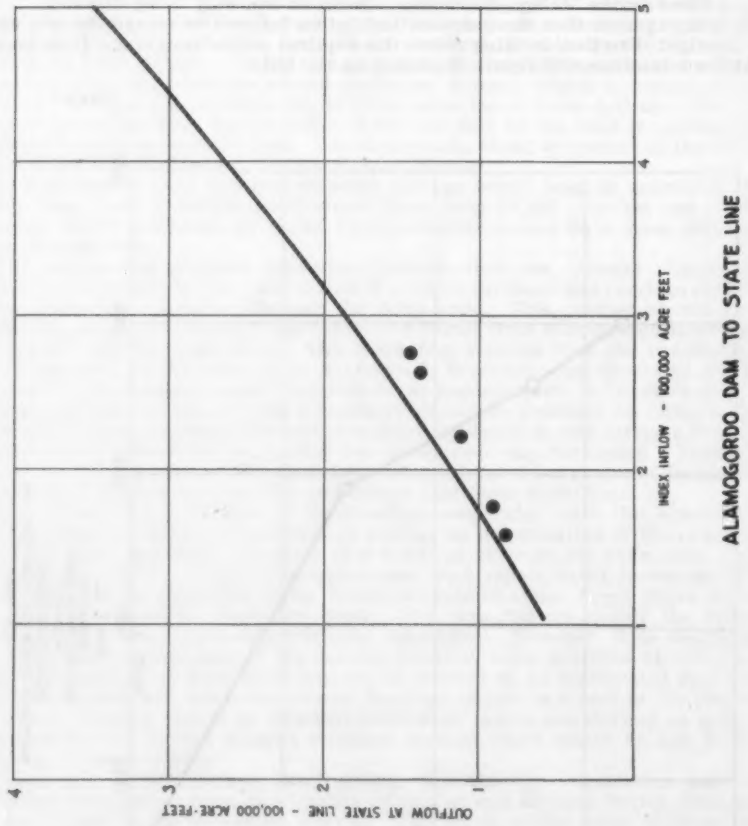
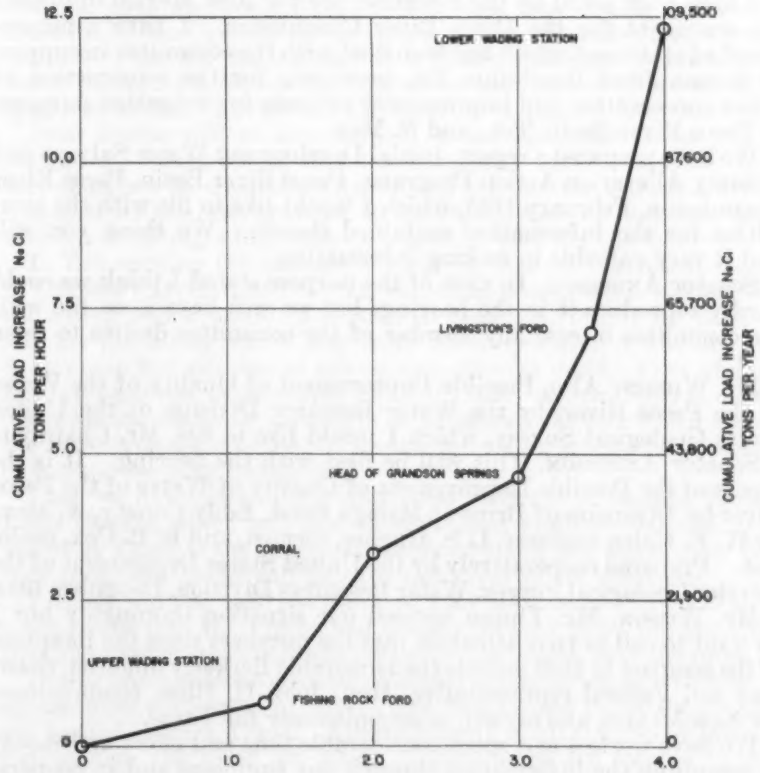

ALAMOGORDO DAM TO STATE LINE
INDEX INFLOW - 100,000 ACRE FEET
OUTFLOW AT STATE LINE - 100,000 ACRE-FEET
1
2
3
4
5

Figure 3



Feb. 1953

Senator ANDERSON. Mr. Wilson, will you state your name and your position in this situation?

STATEMENT OF J. C. WILSON, PECOS, TEX., COMMISSIONER FOR TEXAS, PECOS RIVER COMMISSION

Mr. WILSON. Mr. Chairman and members of the committee, I am J. C. Wilson, of Pecos, Tex., Texas commissioner for the Pecos River Commission.

I have been asked by the commissioner for New Mexico to present the statement for the Pecos River Commission. I have a mimeographed statement which has been filed with the committee in support of Senate Joint Resolution 155, providing for the construction of water conservation and improvement projects for irrigation purposes in Pecos River Basin, Tex., and N. Mex.

We have prepared a report, Initial Development Water Salvage and Salinity Allevation Action Programs, Pecos River Basin, Pecos River Commission, February 1955, which I would like to file with the committee for the information contained therein. We think you will find it very valuable in seeking information.

Senator ANDERSON. In view of the purpose stated I think we could hardly reproduce it in the hearings but we will have it on file with the committee in case any member of the committee desires to refer to it.

Mr. WILSON. Also, Possible Improvement of Quality of the Water of the Pecos River, by the Water Resource Division of the United States Geological Survey, which I would like to file, Mr. Chairman.

Senator ANDERSON. This will be filed with the hearing. It is the report of the Possible Improvement of Quality of Water of the Pecos River by Diversion of Brine at Malaga Bend, Eddy County, N. Mex., by W. E. Hales, engineer, L. S. Hughes, chemist, and E. R. Cox, geologist. Prepared cooperatively by the United States Department of the Interior Geological Survey, Water Resources Division, December 1954.

Mr. WILSON. Mr. Tipton covered our situation thoroughly but I do want to call to your attention that the members since the inception of the compact in 1949 include the Honorable Berkeley Johnson, chairman and Federal representative, Hon. John H. Bliss, commissioner for New Mexico, and myself, as commissioner for Texas.

We have worked and spent considerable time and effort and money in compiling the information through our engineers and in cooperation with the various Federal agencies who have cooperated with our engineers, and we certainly appreciate their efforts in our behalf.

The resolutions are the result of nearly 6 years of study and negotiation by the Pecos River Commission in cooperation with appropriate Federal agencies, local water and irrigation districts, and other interested groups in both States who are familiar with the proposal.

The Commission is gratified to report that there is no known opposition in either State to the legislation.

We are very glad indeed that we have harmony existing between the two States.

Senator ANDERSON. I might say, Mr. Wilson, that I am a little sorry that I had to delay the introduction of this bill as long as I did, but I thought it was far more important that we have agreement between

the States of New Mexico and Texas before we came before the Congress rather than that we hurry forward with something and then find one State in opposition to it.

Mr. WILSON. Because we couldn't get very far that way.

Senator ANDERSON. I am very happy that there is now agreement.

Mr. WILSON. We appreciate that.

The purpose of the legislation is to improve the poor quality and increase the limited quantity of Pecos River water available in Texas and New Mexico for irrigation, by providing for construction upon a nonreimbursable basis, of a 1,500 cubic feet per second water salvage channel, with uncleared floodway but with spur drains sufficient to drain McMillan Delta, in accordance with plans described in the report entitled "Plan for McMillan Delta Water Salvage Channel, Pecos River Basin, New Mexico," prepared by the Bureau of Reclamation, approved by the Secretary of the Interior and dated November 1954.

Spur drains will be incorporated in the McMillan water salvage plan to the fullest extent found economically feasible, and the floodway shall not be cleared until terminal storage for Carlsbad Irrigation District has been provided in anticipation of the increased depletion due to silting which may be caused by clearing the floodway.

In determining the amount of depletion of such terminal storage in Carlsbad Irrigation District, the computation shall include only the silting which would have resulted from clearing of the floodway and not the silting which may occur from operation of the low flow, 1,500 cubic feet per second conveyance channel itself. Cost of water salvage program is estimated at $2,161,000. Annual operation and maintenance costs will amount to an estimated $52,800, which amount the two States have agreed to assume jointly on an equitable basis as circumstances may determine.

Then we have the salinity alleviation program at Malaga Bend in Eddy County which will cost an additional $150,000, but due to the fact that Texas is the principal beneficiary and sole beneficiary from that program, Texas will pay the total cost of its operation.

I didn't want to take too much of your time but I did want to hit a few points that Mr. Tipton had already covered, to let you know that the Commission as a whole are 100 percent in accord with the program.

In this area the basin consists of 35,000 square miles, of which 20,000 square miles are located in eastern New Mexico and 15,000 square miles are located in west Texas. Approximately 210,000 acres of land are irrigated in the basin, of which 156,000 acres are located in New Mexico and 54,000 acres are located in Texas. Of the 156,000 acres in New Mexico, approximately 43,600 acres are irrigated by diversions of the main stream. The remainder is irrigated by groundwater or by tributaries.

In Texas about 40,000 acres of the 138,000 acres in Red Bluff Water Power Control District have ordinarily been irrigated by waters of the main stream, although drought conditions have made it possible this year to irrigate only 6,000 acres with Pecos River water.

I wanted to bring that out to show you the seriousness of the situation. Under the compact we are charged with the responsibility of increasing the quantity and improving the quality. Unless some relief is given——

Senator ANDERSON. And unless there is Federal assistance, you cannot increase the quantity or improve the quality.

Mr. WILSON. That is right; we can't do either.

From this and other comprehensive studies the Commission's engineer advisory committee has determined that salt cedars and other water-loving vegetation are expanding in the river's middle basin at the rate of about 1,600 acres per year.

The Commission recognizes with grave concern that the compact is losing out to nature. There are now 40,000 acres of salt cedars in the middle basin, which exceeds the acreage subject to irrigation in the same area. Experiments indicate that as much as 6 acre-feet of water are consumed annually by each acre of salt cedars in the middle basin.

I want to qualify that. That is when the water is made available. If the water is not available, of course they do not consume that amount. But that gives you an idea of the volume of water that the salt cedars and other water-loving plants are consuming which ordinarily did come down the river prior to the time the salt cedars took over.

Senator ANDERSON. They have the ability to drink it up if it is there.

Mr. WILSON. Yes, sir.

This represents a nonbeneficial consumption of approximately 240,000 acre-feet of water annually, or a loss of about 65,000 acre-feet of water more each year than is used by the irrigation projects in the middle basin. That will show the rapid rate of increase, 1,600 acre-feet a year. If we don't do something the river channel itself will be completely dumped. I don't want to take too much of your time. I know there will be several others. I appreciate the opportunity of appearing before you. If there are any questions that I can answer I would be glad to do so, bearing in mind, however, that I am not an engineer. I am just a farmer.

Senator ANDERSON. Thank you. We will carry the statement in full in the proceedings.

(The prepared statement of J. C. Wilson, commissioner for Texas, Pecos River Commission, follows:)

STATEMENT OF J. C. WILSON, COMMISSIONER FOR TEXAS, PECOS RIVER COMMISSION

The Pecos River Commission, whose members, since its inception in 1949, have included Hon. Berkeley Johnson, Chairman and Federal representative, Hon. John H. Bliss, Commissioner for New Mexico, and myself, as Commissioner for Texas, joined herein by Red Bluff Water Power Control District, comprising substantially all Pecos River water users in Texas, respectfully urges approval of Senate Joint Resolution 155 and its counterpart, House Joint Resolution 563, now before the Committees on Interior and Insular Affairs for consideration.

The resolutions are the result of nearly 6 years of study and negotiation by the Pecos River Commission, in cooperation with appropriate Federal agencies, local water and irrigation districts, and other interested groups in both States who are familiar with the proposal. The Commission is gratified to report that there is no known opposition in either State to the legislation.

The purpose of the legislation (S. J. Res. 155) is to improve the poor quality and increase the limited quantity of Pecos River water available in Texas and New Mexico for irrigation, by providing for construction, upon a nonreimbursable basis, of a 1,500 cubic feet per second water salvage channel, with uncleared floodway but with spur drains sufficient to drain McMillan Delta, in accordance with plans described in the report entitled "Plan for McMillan Delta Water Salvage Channel, Pecos River Basin, New Mexico," prepared by the Bureau of Reclamation, approved by the Secretary of the Interior, and dated November 1954.

Spur drains will be incorporated in the McMillan water-salvage plan to the fullest extent found economically feasible, and the floodway shall not be cleared until terminal storage for Carlsbad Irrigation District has been provided in anticipation of the increased depletion due to silting which may be caused by clearing the floodway.

In determining the amount of depletion of such terminal storage in Carlsbad Irrigation District, the computation shall include only the silting which would have resulted from clearing of the floodway and not the silting which may occur from operation of the low flow 1,500 cubic feet per second conveyance channel itself.

Cost of water-salvage program is estimated at $2,161,000. Annual operation and maintenance costs will amount to an etstimated $52,800, which amount the two States have agreed to assume jointly on an equitable basis as circumstances may determine.

The legislation also provides for construction, upon a nonreimbursable basis, of works for the alleviation of salinity near the upper end of the lower basin, in accordance with the report entitled "Possible Improvement of Quality of Water of the Pecos River by Diversion of Brine, Malaga Bend, Eddy County, N. Mex.," prepared by the Water Resources Division, Geological Survey, dated December 1954.

This project will cost an estimated $150,000. Annual operation and maintenance expenses, estimated at $4,300, will be borne by Texas alone, since it is principal beneficiary of the project. The legislation provides for Texas and New Mexico to make substantial contributions to the cost of construction of the water salvage channel and salinity alleviation facilities, if the Federal Government joins them in sharing such construction costs.

The proposed construction at both McMillan and Malaga Bend has been carefully analyzed in a detailed report published in February 1955 by the Pecos River Commission, entitled, "Initial Development, Water Salvage and Salinity Alleviation Action Programs, Pecos River Rasin."

In order to understand and determine the need for this legislation, it is necessary to know something of the basin's history. Historically the Pecos River Basin is divided into three parts: The upper basin, which consists of the area above Alamogordo Reservoir; the middle basin, which comprises the area between Alamogordo Reservoir and the Texas-New Mexico State line; and the lower basin, which is the area in Texas. The basin consists of 35,000 square miles, of which 20,000 square miles are located in eastern New Mexico and 15,000 square miles are located in west Texas. Approximately 210,000 acres of land are irrigated in the basin, of which 156,000 acres are in New Mexico and 54,000 acres are located in Texas.

Of the 156,000 acres in New Mexico, approximately 43,600 acres are irrigated by diversions of the main stream. The remainder is irrigated by ground water or by tributaries. In Texas about 40,000 acres of the 138,000 acres in Red Bluff Water Power Control District have ordinarily been irrigated by waters of the mainstream, although drought conditions have made it possible this year to irrigate only 6,000 acres with Pecos River water.

In the upper basin, historians are generally agreed that the expansion of irrigation coincided with the Spanish colonization at the close of the 18th century. Prior to that time there had been some irrigation by the Pueblo Indians, much as there had been by the Plains Indians in the lower basin before then. With the exception of development of the Storrie project about 40 years ago, however, development in the upper basin has remained about the same as it was at the time of the Spanish colonization.

In the middle basin, the first irrigation was the Fort Sumner project. It was constructed in 1863 after General Carlton rounded up the Apaches and the Navahos, and was rehabilitated in 1906. The principal irrigation developments in the middle basin today are the Fort Sumner project, the Roswell artesian area and the Carlsbad project.

Development in the Roswell area by use of surface waters did not commence until 1889 and the use of artesian water began in 1891. This was followed in 1927 by pumping of shallow ground water in the Roswell artesian area. In recent years, there has been a sharp increase in this pumping and it presents a serious problem to the Pecos River Commission under the compact. The Carlsbad project did not come into being until 1887 and the facilities to serve the project, including McMillan and Avalon Reservoirs, were not completed until 1893. Many difficulties were encountered in maintaining the Carlsbad system which was severely damaged in the flood of 1904, and in 1906 the Carlsbad project was taken over by the United States Reclamation Service.

In the lower basin, the first irrigation development took place in 1876. Thereafter, canals and irrigation ditches were constructed to serve at 1 time or another 10 irrigation projects which stretched along the river in Texas from Arno to Girvin. These early lower basin projects included Barstow, Arno, Portersville, Farmers Independent, Biggs, Big Valley, Grandfalls, Imperial, Zimmerman, and Victor. The uses and appropriations of the water made by these early districts have been largely continued up to the present time by seven districts which, since 1934, have been known as Red Bluff Water Power Control District. These constituent districts are:

Loving County No. 1, Reeves County No. 2, Ward County No. 3, Ward County No. 1, Ward County No. 2, Pecos County No. 2 and Pecos County No. 3.

Turning from the history of the basin to its problems one of the major dilemmas of the river has been the large nonbeneficial consumption of its water by native vegetation. When the Pecos River compact was finally signed between Texas and New Mexico in December 1948, after many years of effort by Texas to reach agreement, the Pecos River Commission, which administers the compact, immediately began investigating a water-salvage plan.

Provision for a water-salvage program was expressly set out in the compact. Accordingly, an aerial survey of the river was made by the Commission in 1950–51, and all areas were classified as to use. From this and other comprehensive studies, the Commission's Engineering Advisory Committee has determined the salt cedars and other water-loving vegetation are expanding in the river's middle basin at the rate of about 1,600 acres per year.

The Commission recognizes with grave concern that the compact is losing out to nature. There are now 40,000 acres of salt cedars in the middle basin, which exceeds the acreage subject to irrigation in the same area. Experiments indicate that as much as 6 acre-feet of water are consumed annually by each acre of salt cedars in the middle basin. This represents a nonbeneficial consumption of approximately 240,000 acre-feet of water annually, or a loss of about 65,000 acre-feet of water more each year than is used by the irrigation projects in the middle basin. At the head of Lake McMillan this problem is particularly acute. Over a period of years the 13,000 acres of salt cedars there have effectively retarded, like a sieve, the sediments, allowing the relatively clear water to pass into the reservoir.

In performing this function, however, nature has taken a heavy toll in water. As the delta has been built up by these silt deposits, the channel at the head of Lake MacMillan has slowly been obliterated with the result that in May 1954 flood, 51 percent of the flow passing the Artesia gage was lost. It is estimated by the Bureau of Reclamation and the Commission's Engineering Advisory Committee that an average annual salvage of 24,500 acre-feet can be expected from construction of the proposed water-salvage channel to drain McMillan Delta. This would not be new water but simply water which was formerly available and which would be recaptured from native vegetation. Such salvaged water is apportioned under the compact 43 percent to Texas and 57 percent to New Mexico.

The initial water salvage recommendations of the Pecos River Commission called for the construction of a low-flow channel through the same delta area with a capacity of approximately 1,500 cubic feet per second designed to carry normal flow, smal flash floods and releases from Alamogordo Reservoir.

In addition, it was recommended that a cleared floodway be constructed through the delta area to permit passage of large floods. Carlsbad Irrigation District objected to construction of the cleared floodway as part of the project, however, claiming it might result in loss of storage in McMillan and Avalon Reservoirs through siltation, and that it might also increase flood hazards in the city of Carlsbad.

The board of directors of Red Bluff Water Power Control District and of Carlsbad Irrigation District then submitted to the Pecos River Commission resolutions approving authorization of the projects described in the legislation, but with the understanding that no money shall be appropriated for and no work commenced on the clearing of the water salvage channel floodway until provision shall have been made to replace any Carlsbad Irrigation District terminal storage which might be lost by clearing the floodway.

The legislation contains this express provision. Moreover, at the meeting of the Pecos River Commission held in Santa Fe on February 18, 1956, the representatives of Texas and New Mexico agreed this language means that no money shall be appropriated for or work commenced upon the cleared floodway suggested in the commission's report unless and until adequate terminal storage which it would lose through construction of such cleared floodway.

At this meeting the representatives of the two States also agreed, as reflected by the transcript of proceedings, that spur drains sufficient to drain McMillan Delta to the fullest extent found economically feasible will be incorporated in the final plan, and that in determining the amount of Carlsbad's terminal storage which may be depleted, the computation shall include only that silting and depletion which would have resulted from clearing the floodway and shall not include silting which may result from operation and maintenance of the low flow 1,500 cubic feet per second conveyance channel.

Another major problem on the Pecos River is its incredibly poor quality of water, particularly in the middle and lower basins of the stream. The basin overlies a vast bed of salt and gypsum deposits which outcrop throughout the middle basin. The salt concentration increases during periods of low flow and is diluted during floods. There has always been an inverse relationship between the river's salt concentration and the lower basin's crop yields wherever the water is used for irrigation.

During the early 1900's, before storage facilities were provided in Texas, the lower basin frequently found it difficult to use the stream's quality, water users in the lower basin were therefore forced to rely upon infrequent and uncertain floods to dilute the river's high salt content. With the construction of Red Bluff Reservoir in 1936, and its filling in 1937, it was hoped that the quality of the lower basin's water would improve. When it did not, it was then discovered that a tremendous salt inflow to the river occurs near Malaga Bend in Eddy County, N. Mex., just before the stream enters Texas.

Accretions to the river in a 3-mile stretch in this area provide a spring flow in which a saturated brine is brought to the surface by artesian pressure to produce about 420 tons of dissolved solids each day. Of this amount, 370 tons are common salt. Since the brine inflow enters the river only a short distance upstream from Red Bluff Reservoir, much of the salt tonnage is deposited in the reservoir. Our engineers estimate that 135,000 tons of salt are contributed annually from this source alone to the limited water supply which Texas receives. This year, as a result, only 6,000 acres are being irrigated in Texas' Red Bluff District. This means that approximately 22 tons of salt are contributed to the river at Malaga Bend for each acre of irrigated land in Texas this year. In 1953, as a result of this same condition, it was not possible for any irrigation to take place in the lower basin. Prolonged drought conditions in the basin make it essential, in the opinion of the commission, that this work be accomplished upon a nonreimbursable basis.

Investigations of this salinity problem were begun in 1937 by the Ground Water Branch of the Geological Survey and were intensified by the Pecos River Commission during 1951–54. Our studies indicate that the brine inflow near Malaga Bend can be almost completely stopped. Investigation has located a virtual sea of brine, confined under pressure by the rock strata formation, through which the river has cut its channel. Lakes and fractures in the formation have permitted the brine to escape into the river. The commission is convinced that pumping off the brine aquifer would reduce the hydrostatic pressure to a point which at which the brine would cease to flow into the stream.

Actual pumping tests which were conducted in the Malaga Bend area during 1953 and 1954 showed an immediate reduction in the hydrostatic pressures at numerous observation points in the area. The commission believes that continuation of a program of pumping from the brine aquifer would successfully reduce the hydrostatic pressure and substantially improve the quality of the water which is available for use in the lower basin.

It is contemplated under the legislation that approximately 1,200 acre-feet of brine would be pumped annually into a nearby disposal and evaporation site. After the hydrostatic pressure had been sufficiently reduced, the pumping would then be lowered to about 400 acre-feet per year and continued on that basis.

The Red Bluff District has agreed to assume all operations and maintenance costs of the project. The Geological Survey regards the program as an experiment offering valuable information and experience for use in combating similar problems in other parts of the country.

One of the principal reasons the two States entered into the Pecos River compact was to provide a means for closer cooperation between the Federal Government and Texas and New Mexico in studies and projects designed to make available a greater supply of usable water for beneficial consumptive uses in the Pecos River Basin.

The Bureau of Reclamation and the Geological Survey, after complete investigation, have recommended the construction of the works provided for in the

legislation, and the Pecos River Commission, the two States and their water districts respectively join in that recommendation with the sincere request that the legislation be favorably considered by the committees and authorized by the Congress this session.

Senator ANDERSON. The next witness is Mr. Bliss.

STATEMENT OF JOHN H. BLISS, SANTA FE, N. MEX., COMMISSIONER FOR NEW MEXICO, PECOS RIVER COMMISSION

Mr. BLISS. Mr. Chairman, I have a short prepared statement. I will not attempt to read it.

You have heard an excellent history of the problems of the basin. You have heard of the agreement which has been reached by the compact commission and the two States regarding the current project. As the New Mexico commissioner on the Pecos River Commission I want to say that we agree fully with the statement and the opinions expressed previously regarding this project and the desirability for its early authorization.

Senator ANDERSON. In your statement you have an item about the Rio Grande salvage project. You make the statement that about 38,000 acre-feet of water has been salvaged annually. On the basis of your knowledge and experience with the Rio Grande salvage project, would you say that, if this project is carried out on the Pecos River, there will be a substantial salvage of water on that river as well?

Mr. BLISS. I am sure there will. If I may refer to the chart for a moment, it illustrates graphically what has happened to the Rio Grande. That project was started several years ago. The chart represents accumulative record of the discharge of the stream above and below the salvage project on the Rio Grande. I might point out that this salvage program and the indicated savings which are shown at the top of the chart in blue are the salvage which has occurred during a little over 4 years of very inefficient water supply. If the water supply had been better, the salvage, of course, would have been substantially greater.

I also might point to the fact that the white line lying between the pink and the blue lines is the difference between the salvage which was computed by the Bureau of Reclamation originally in their project report and the actual which has occurred. I would point out that at the end of the 1955 water year we have actually salvaged about 15 years more than was estimated. But I think the point is that in the Pecos River project the salvage would be at least as great as it would in the Rio Grande proportionately and it probably is conservative.

Senator ANDERSON. Mr. Wilson said if we didn't do something soon we might lose most of the agricultural area entirely. Now, on the Rio Grande, how effective has this salvage-water program been to the Rio Grande project farmers below the Narrows? Hasn't it been about the only source of the water? Without it they would have been almost entirely without water. Isn't that right?

Mr. BLISS. That is right. I will illustrate that this way: Under the Rio Grande compact for a number of years we have had difficulty; in fact, the Rio Grande project and the Salvation project is part of the rehabilitation program of the Middle Valley to salvage some

of this water and to permit the State of New Mexico to make her deliveries on downstream in accordance with the compact.

During the year 1955 for the first time in several years, directly as a result of this salvage project, we were able to deliver more water than was required under that compact.

Senator ANDERSON. The whole purpose of the Rio Grande compact, is it not, is to permit these States which entered into the agreement to be able to live together peaceably and not be in constant argument about who delivers what water and so forth? We have entered into a compact with the State of Texas. If through the use of a salvage project we are able to live up to that compact so that the residents of the two States don't have controversy between themselves; isn't that the desirable thing for the Government to do?

Mr. BLISS. Very much so, I would say; yes.

Senator ANDERSON. Has it not resulted in improvement in the situation in the Rio Grande once the salvage project was under way?

Mr. BLISS. I am sure it has. I am sure it will be the answer to that very difficult problem we have had.

Senator ANDERSON. I am glad to have your testimony on it, because, as someone who has had to deal with the Texas side of it a little bit, I have found that the water salvage project has tremendously improved our relationships on the Rio Grande. Texas recognizes that through the salvage project we have done what you mentioned a moment ago, lived up to the delivery of the water, which is a pretty hard thing to do. This will permit us in New Mexico, as the upstream State, to be able to deliver to the lower State what we have hoped by compact would be delivered to them. I am sure you regard that as a desirable result.

Mr. BLISS. Yes, sir.

Senator ANDERSON. Do you have any questions, Seantor Laird?

Senator LAIRD. No.

Senator ANDERSON. Do you have an additional statement?

Mr. BLISS. No.

Seantor ANDERSO. Thank you very much.

(Mr. Bliss' prepared statement follows:)

STATEMENT OF JOHN H. BLISS, NEW MEXICO COMMISSIONER ON THE PECOS RIVER COMMISSION

My name is John Bliss. I am New Mexico commissioner on the Pecos River Commission, and have taken an active part in the negotiations of the New Mexico-Texas interstate compact and in the planning of the Pecos water salvage and salinity program.

You have already heard an excellent resumé of the history of developments on the river leading up to the pending legislation. This program has received the consideration and general approval of the Pecos River Commission at each stage of its development. The report of the commission was formally approved and adopted February 28, 1955. Since then, agreement has been reached between the States to delay completion of a part of the program until the question of replacement storage for the Carlsbad Irrigation District shall have been resolved.

Of the total of about 55,000 acre-feet nonbeneficially consumed in the delta area above Lake McMillan, it has been estimated that 25,000 acre-feet can be salvaged annually by the proposed project. This figure of water salvage has been reached as a result of careful studies by the Bureau of Reclamation and by the engineering advisory committee of the Pecos River Commission. It is believed to be conservative.

As an example of the results which this type of project can be expected to attain, the attention of the subcommittee is invited to the Middle Rio Grande

project where a similar program has been completed in the past 4 years. Large losse sof water in the delta area above Elephant Butte Reservoir on Rio Grande have been substantially reduced by a program of low-water channel and floodway construction almost identical with that planned for the Pacos. The water salvaged has exceeded the original estimates made by the Bureau of Reclamation by almost 15 percent.

The basic data on water losses and salvage for the Rio Grande project are as follows:

Rio Grande salvage project—Water losses and salvage, San Antonio to the Narrows

[Unit—1,000 acre-feet]

Item	June 1, 1951 to Sept. 30, 1952	Water year 1953	Water year 1954	Water year 1955	June 1, 1951 to Sept. 30, 1955
Rio Grande at San Antonio	1,096	337	239	286	1,958
Rio Grande at Narrows:					
Measured	925	286	210	272	1,693
Computed	892	249	181	206	1,528
Losses:					
Measured	171	51	29	14	265
Computed	204	88	58	80	430
Walter salvage:					
Measured	33	37	29	66	165
Computed	28	32	41	43	144

The table indicates that from June 1951 through September 1955, an average of about 38,000 acre-feet of water has been salvaged annually. During this period the project was under construction and the whole area was passing through a prolonged cycle of deficient streamflow. It is evident that the quantity salvaged will be substantially higher as river flows again become normal. That this project is eminently effective is evidenced by the fact that for 1955 the discharge of the river at the lower end of the Middle Valley has exceeded the computed schedule outflow of the Rio Grande compact for the first time in a number of years. A similar salvage program in the Pecos River Basin above McMillan reservoir will aid materially in restoring some of the water supply formerly available to the Carlsbad and Red Bluff Districts.

As the New Mexico member of the Pecos River Commission, I fully endorse the water salvage and salinity alleviation programs now before this subcommittee and solicit the early approval of the project by the Congress.

Senator ANDERSON. The next witness is Mr. Stagner.

STATEMENT OF JAMES W. STAGNER, ATTORNEY AT LAW, REPRESENTING CARLSBAD IRRIGATION DISTRICT

Mr. STAGNER. My name is James W. Stagner. I am an attorney representing the Carlsbad Irrigation District. We have prepared a statement which sets forth the agreement had between New Mexico and Texas with reference to this legislation and which points out the meaning, which is not readily apparent from a reading of the bill.

The agreed basis or understanding of the meaning of the bill which has been offered is that there shall be constructed through the McMillan Delta area in New Mexico what is called the low-flow channel, a carrying channel capable of delivering approximately 1,500 cubic feet of water per second through that area.

The plan originally envisions and still envisions a cleared floodway through the McMillan Delta area. It has been agreed between the two States that that cleared floodway shall not be constructed nor shall money be appropriated for its construction until adequate replacement storage for the Carlsbad project has been actually constructed.

The reason for that agreement from the standpoint of the people I represent is that the Carlsbad project derives its water supply from the Pecos River. It has three dams, two of which we classify as terminal storage dams. One is the Avalon Dam which you have seen on the map. It is located approximately 7 miles above our project and has a present storage capacity of about 6,500 acre-feet. The McMillan Dam, approximately 14 miles above our project, still has a storage capacity of approximately 35,000 acre-feet. Our first reservoir, the Alamogordo Reservoir, constructed approximately 170 miles upstream from our project. It was constructed by the Bureau of Reclamation at that site by reason of the scarcity of available storage reservoir spaces on the stream. Otherwise, it would have been from the standpoint of use of water much more desirable to have it located near the project that it serves.

The best engineering information that we have been able to obtain shows that if the saltcedars in the McMillan Delta area cease to serve the purpose that they have been serving, that is, to cause the deposition of silt carried by the stream at that point rather than carrying it into storage reservoirs, one major flood on the Pecos River could mean the destruction of the remaining available storage in our Avalon Reservoir and our McMillan Reservoir.

Those two storage reservoirs are substantially the lifeblood of our project, and that is the reason that we have in this agreement our understanding of the meaning of this legislation that the cleared floodway shall not be constructed until adequate replacement storage is constructed to take the place of storage we would lose in Avalon Reservoir and McMillan Reservoir from the siltation following the construction of the cleared floodway.

Our statement which we have prepared and which I do not desire to read is complete except for one fact, which by inadvertence has not been included. I wish to state that into the record for that reason.

The agreement had is that there shall be constructed the low-flow channel, and in addition in the McMillan Delta area there shall be constructed spur drains to the extent that their construction is economically feasible to drain waters from that area to the low flow channel itself. That is a part of the agreement between the two States.

My sole purpose in appearing here was to make it clear that that was the nature of the understanding between the two States and to make that a part of the record.

I am grateful for the opportunity of appearing.

(Mr. Stagner's prepared statement follows:)

STATEMENT OF CARLSBAD IRRIGATION DISTRICT

It is the purpose of this instrument to present the position of Carlsbad Irrigation District with reference to Senate Joint Resolution 155, which authorizes the construction of certain water-conservation projects to provide for a more adequate supply of water for irrigation purposes in the Pecos River Basin, N. Mex. and Tex., and for works for the alleviation of salinity in such basin.

STATUS OF CARLSBAD IRRIGATION DISTRICT AND ITS INTERESTS IN WATERS OF THE PECOS RIVER

Carlsbad Irrigation District is a quasi-municipal corporation organized and existing under the laws of New Mexico, with its corporate residence and place of business at Carlsbad, Eddy County, N. Mex.

Carlsbad Irrigation District operates what is known as the Carlsbad project, which is a United States reclamation project in the southern portion of Eddy County, N. Mex. The irrigated lands under the project consist of a total of 25,055 acres of land.

Carlsbad Irrigation District water users derive their water supply from the Pecos River and the rights are based upon appropriations made between and including the years 1887 and 1906.

The works of the district consist of a main canal running through the project which derives its water by direct diversion from Avalon Dam, which is situated approximately 7 miles above Carlsbad, N. Mex., and is one of the district works. In addition, McMillan Dam is situated on the Pecos River approximately 22 miles above Carlsbad, N. Mex., and Alamogordo Dam is situated on the Pecos River approximately, 170 miles north of Carlsbad, N. Mex. These are dams of the district.

Avalon Reservoir presently has a storage capacity of approximately 7,000 acre-feet and McMillan Reservoir has a present storage capacity of approximately 35,000 acre-feet. The Alamogordo Reservoir has a present storage capacity of approximately 128,000 acre-feet.

The works of the project were constructed by the United States through its Bureau of Reclamation, and the cost thereof, with the exception of the Alamogordo Reservoir and certain improvements to the canals, has been repaid to the United States. Indebtedness to the United States on account of construction for the project is presently current. Carlsbad project is the largest single water user on the Pecos River in New Mexico, and is located in the extreme southern portion of New Mexico at a point approximately 30 to 40 miles north of where the Pecos River crosses the State line of Texas.

COMPACT BETWEEN STATES OF NEW MEXICO AND TEXAS

In 1948 a compact was made between the States of New Mexico and Texas, which came as a result of many years of effort by representatives of both States. The prime reasons motivating the compact were the elimination of prospective expensive litigation between the States relative to the waters of the Pecos River and the provision of means by which improvement of the water supply of the Pecos River for the benefit of both States might be activated and achieved. Following the adoption of the compact the Pecos River Commission, which administers compact affairs, has conducted and has cooperated in the making of studies for the purpose of achieving the purposes of the compact.

PROBLEMS INVOLVED IN THE IMPROVEMENTS SUGGESTED BY THE STUDIES OF THE PECOS RIVER COMMISSION

The Pecos River Commission has suggested improvement in what is known as the McMillan-Delta area and a program for alleviation of salinity in the Malaga Bend area of the Pecos River as the most urgent primary needs for the improvement of water supply for irrigation for the benefit of both the States of New Mexico and Texas.

The McMillan Delta area is an area lying between the present usable portion of the McMillan Dam storage and a point upstream therefrom approximately 25 miles distant. At the time McMillan Dam was constructed it was estimated by the engineers familiar with the problem that its life span for usable storage would be approximately 30 years. It initially had a capacity of 90,000 acre-feet. The dam was constructed in about the year 1890, so that the present usable storage has exceeded the expectation of the original engineering estimates by some 35 years. The reason for the extended life of this storage has been that a saltcedar growth occurred in the upper reaches of the reservoir area, and along the river to the northward, which had the effect of reducing velocities of flood flows so as to permit the deposition of silt normally expected to reach the bed of the reservoir at a point above such bed. This, carried forward through the years, has resulted in the deposition of vast mounds of silt through the area described above, with the result that both floodwaters and the normal release of stored water from the Alamogordo Dam have been substantially diminished and lost for irrigation purposes.

The initial recommendation of the Pecos River Commission for alleviation of this problem suggested the construction of a low-flow channel through the Delta area having a capacity of approximately 1,500 cubic feet per second which was designed to carry normal flow, small flash floods, and releases from the Alamo-

gordo Reservoir. In addition, it was suggested that a cleared floodway be constructed through the Delta area to permit the passage of large floods without their being impeded by the silt deposits and the growth of saltcedars in the area. This latter construction would result in the delivery of water in extreme floods directly into the remaining storage of McMillan Reservoir without a reduction in velocity, and would result in the deposition of the silt loads into the present usable storage remaining at this site. The best engineering estimates the irrigation district has been able to obtain indicate that one major flood might, with the construction of the cleared floodway, result in destruction of the remaining storage capacity of this reservoir.

SCARCITY OF STORAGE SITES ON THE PECOS RIVER IN NEW MEXICO

The scarcity of sites for storage of waters on the Pecos River in New Mexico, is best illustrated by the fact that the Carlsbad Irrigation District, on the advice of the United States Bureau of Reclamation, constructed its present principal storage, being the Alamogordo Dam, at a repayment cost of approximately $2 million, at a site 170 miles above its point of diversion on the Pecos River, realizing that the waters stored at such point would be required to be delivered to project lands through this stretch of approximately dry-stream bed. Objective long-range thinking on the use of waters of the river in New Mexico for irrigation purposes concludes that no available storage should be wasted.

OBJECTIONS OF CARLSBAD DISTRICT TO THE CONSTRUCTION OF THE CLEARED FLOODWAY

Carlsbad Irrigation District has objected to the construction of the cleared floodway as a part of the program for the saving of water in the McMillan Delta area for the reason that it would result in the loss of storage in McMillan and Avalon Dams through siltation. These are the terminal storage dams of the Carlsbad Irrigation District and there has been no assured replacement of such existing storage in connection with the plan. The seriousness of the loss of this terminal storage to Carlsbad Irrigation District cannot be overemphasized for the reason that such storage has been, in recent years, the difference between crop failures and substantial crops on project lands. This storage, though limited in quantity, has been sufficient to permit the handling of flash floods originating in New Mexico above the site of McMillan Reservoir and below the Alamogordo Dam for utilization on project lands and the history has been that these have occurred with sufficient regularity at times when most needed to show that the loss of this storage would result substantially in the destruction of the project itself.

BASIS OF AGREEMENT OF CARLSBAD IRRIGATION DISTRICT TO SENATE JOINT RESOLUTION 155

Agreement was reached by the Pecos River Commission to the terms of Senate Joint Resolution 155 after consultation with representatives of Carlsbad Irrigation District in New Mexico, and the representatives of Red Bluff Water Control District. Red Bluff Water Control District represents seven irrigation districts in the State of Texas, which are substantially all of the users of waters of the Pecos River in Texas.

Water users of both Carlsbad Irrigation District and Red Bluff Water Control District recognize that the construction of the low-flow channel in the McMillan Delta area will result in substantial water savings to the stream system. Both likewise recognize the probable loss of terminal storage to Carlsbad project resulting from the construction of the cleared floodway and the resultant effect of such losses on the life of the Carlsbad project. Accordingly, the board of directors of the Red Bluff Water Control District and of the Carlsbad Irrigation District furnished to the Pecos River Commission resolutions approving authorization of the projects described in Senate Joint Resolution No. 155, but with the understanding that no moneys would be appropriated for and no work would be commenced upon the construction of the cleared floodway referred to above until adequate terminal storage for Carlsbad project to replace that to be lost through construction of the cleared floodway had been assured. Accordingly, Senate Joint Resolution 155 embraces this proviso.

MEANING OF THE PROVISO AS STATED BY BOTH THE REPRESENTATIVES OF THE STATE OF TEXAS AND OF NEW MEXICO AT THE TIME OF AGREEMENT ON SENATE JOINT RESOLUTION 155

While the minutes of the meeting of the Pecos River Commission held at Santa Fe, N. Mex., on February 18, 1956, do not reflect a transcript of the statements made by the representatives of New Mexico and Texas into the records of that meeting, such statements were taken by a reporter for the purpose of preserving the same. The meaning of the proviso contained in Senate Joint Resolution 1955, appearing at page 3, line 12 of the bill as follows:
"*Provided, however*, That no moneys shall be appropriated for and no work commenced on the clearing of the floodway called for in said report unless provision shall have been made to replace any Carlsbad Irrigation District terminal storage which might be lost by the clearing of the floodway"

is that no moneys shall be appropriated for or work commenced upon the cleared floodway suggested in the report of the Pecos River Commission unless and until adequate terminal storage shall have actually been constructed for Carlsbad project to replace terminal storage which it would lose through such construction. It was agreed between the representatives of the State of Texas and of New Mexico at the meeting of the Pecos River Commission held in Santa Fe on February 1956 that the quoted provision of the bill was intended to and did have this meaning. This agreement afforded the basis of the withdrawal of objection by Carlsbad Irrigation District to the provisions of Senate Joint Resolution 155 and caused it to lend its support to the enactment of this bill.

POSITION OF CARLSBAD IRRIGATION DISTRICT WITH RESPECT TO THE PROVISIONS OF THE BILL RELATING TO ALLEVIATION OF SALINITY

The provisions of Senate Joint Resolution 155 atuhorizes works for alleviation of salinity in the Malaga Bend area in New Mexico on the Pecos River. The point of which this work will occur is below the point of diversion of the Carlsbad Irrigation District from the Pecos River and the work will, therefore, have no effect upon the water supply of the Carlsbad Irrigation District. Carlsbad Irrigation District is, however, familiar with the problem involved and is of the opinion that the program promises a warranted improvement in water qualities for the benefit of water users in the State of Texas and minor users in the State of New Mexico, and therefore, endorses these provisions.

Senator ANDERSON. I want to commend you, Mr. Stagner, for setting forth all the understandings that you may have had with reference to this proposal. I will give an example of why this is important. As you know, in the Senate Committee on Interior and Insular Affairs and particularly in the Irrigation and Reclamation Subcommittee, we have been perplexed many times about the Colorado River Compact. To give you just one illustration of it, with which Mr. Nielsen is very familiar, there is a provision relating to a million acre-feet of water that is available somewhere in the basin.

My remembrance as a person who wrote some news stories about the Colorado River developments, was that that related to the water of the Gila River, but nowhere in any of the documents that we have been able to discover does anyone now know what it relates to. There are certain other provisions in the compact that everybody understood at the time they were completed. Everybody in Santa Fe in 1922 knew exactly what they meant. Nevertheless, that is not now the case. In an effort to shed some light on this, I have made an effort to find some notes I made as a reporter back then to see if I could find out what it meant. But I have not located my own notes of 1922, and apparently nobody else preserved notes on those particular things either.

I don't think there is any possibility of a misunderstanding with our Texas friends or with the Bureau of Reclamation or any one else, but

I am happy to see put into the document what you are talking about so a future committee can find this in our records and can see what the understanding and agreement was at that time.

I just wanted to commend you for setting it forth. I am sure that the commissioners from both States will realize that it is important to have all the understandings along with it. As one of the authors of the bill I am particularly happy to have that.

The next witness is Mr. C. J. Anderson, manager of the Red Bluff District.

STATEMENT OF. C. J. ANDERSON, GENERAL MANAGER AND ENGINEER, RED BLUFF WATER POWER CONTROL DISTRICT, PECOS, TEX.

Mr. ANDERSON. Mr. Chairman and gentlemen of the committee, you have before you, I believe, the statement that I have prepared. I would like to give some oral testimony with respect to the Red Bluff project in our vicinity and its betterment on the river.

My name is C. J. Anderson. I am general manager and engineer of the Red Bluff Water Control District. The Red Bluff Water Power Control District consists of 7 irrigation districts of some 138,000 acres, 45,000 of which received water before 1946, the date that we entered this long drought we are in now.

Irrigation according to history first began in this area in 1876. That is down toward Fort Stockton, Tex. Now there are seven constituent districts known as the Red Bluff Water Power Control District. This district begins at the Texas-New Mexico State line and extends downriver approximately 125 miles.

As manager of the Red Bluff Waterpower Control District, and also as an engineer-adviser to the Pecos River Commission, I am keenly interested, naturally, in these betterments on the Pecos River. However, I won't take up your time to go into details and facts which you have just heard, especially since you have before you my written statement.

We are naturally keenly interested in the salvage water in the McMillan Delta in area and the spur drains, and I am very much interested in the Malaga Bend salt alleviation project. As you have heard, there are approximately 420 tons of dissolved solids, of which 370 are almost pure salt, per day entering the Pecos River in this small area of some 600 acres inside the bend of the river. This salt alone on our project will amount to approximately 3 tons of salt to every acre of land in the project per year. So you can see that we have to have water to leach the salt below the surface to stay in production.

There have been times during low flow when the salt contributed in the Malaga Bend would amount to 40 percent. I don't have the exact figure in my mind, Senator, approximately 40 percent.

Senator ANDERSON. You can correct the record if you find it different when you check the figures.

Mr. ANDERSON. Approximately 40 percent of all the salt being contributed by the Pecos River water to the land of the Red Bluff system comes from the Malaga Bend area.

With that, Senator, I conclude my testimony unless you have questions.

Senator ANDERSON. Do I understand that you, as manager of the Red Bluff area state that this bill, Senate Joint Resolution 155 as now drawn, is satisfactory to your people.

Mr. ANDERSON. Yes, sir.

Senator ANDERSON. You would be happy to see it passed?

Mr. ANDERSON. Yes, sir.

Senator ANDERSON. Thank you very much.

(Mr. Anderson's prepared statement follows:)

STATEMENT OF C. J. ANDERSON, GENERAL MANAGER AND ENGINEER OF RED BLUFF DISTRICT, PECOS, TEX.

My name is C. J. Anderson. I have been associated with the Red Bluff district since 1940. Since 1943 I have been general manager and engineer of the district with main offices in Pecos, Tex.

Irrigation from the Pecos River in Texas began in 1876, and thereafter many canals and ditches were constructed in the 10 irrigation projects which stretched from the State line along the river for a distance of 125 miles. These early lower basin projects were:

Barstow, Arno, Portersville, Farmers Independent, Biggs, Big Valley, Grandfalls, Imperial, Zimmerman, and Victor. The uses and appropriations of the water made by these early districts have been largely continued up to the present time by seven districts, which, since 1934, have been known as Red Bluff Water Power Control District. These districts are Ward County No. 1, Ward County No. 2, Ward County No. 3, Loving County No. 1, Reeves County No. 2, Pecos County No. 2, and Pecos County No. 3. Red Bluff Water Power Control District is a political subdivision of the State of Texas, created by an act of the 39th legislature in 1925, with its principal place of business in Pecos, Reeves County, Tex.

The Red Bluff system embraces 138,000 acres of land. Ordinarily 45,000 acres of the land within the district are irrigated with Pecos River water, although, as the drought took its toll the number of acres which could be irrigated from the river has steadily declined until this year there were only 6,000 acres being irrigated in Texas with Pecos River water. In 1953 no land in Texas was being irrigated from the Pecos River.

The works of the Red Bluff District consist of a storage reservoir of 270,000 acre-feet capacity known as the Red Bluff Reservoir which is located near the State line at the head of the 125-mile long district. Red Bluff Dam was constructed as a PWA project at a cost of approximately $3 million. Approximately one-half of this cost has been repaid to the United States and the balance of the indebtedness is on a current basis despite general drought conditions since 1946. The 7 constituent districts in the Red Bluff system have constructed and maintained approximately 250 miles of ditches capable of irrigating 125,000 of the 138,000 acres in the system, if the water were available.

In 1948 a compact was signed between Texas and New Mexico after many years of negotiations. In 1950 I became an engineering adviser to the Texas commissioner on the Pecos River Commission which administers the compact. The compact expressly provides for a water-salvage program and shortly after I became engineering adviser, an aerial survey of the Pecos River from its headwaters to the State line was made.

This survey, together with other comprehensive studies showed that phreatophytes are expanding in the middle basin (from Fort Sumner to the State line) at the rate of approximately 1,600 acres annually. At the rate it is going now the compact has been losing out to nature. Approximately 6 acre-feet of water per year are consumed annually by each acre of salt cedar. There are now 40,000 acres of salt cedars located between Alamogordo Reservoir and the State line. This represents a nonbeneficial consumption when the water is available of approximately 240,000 acre-feet of water annually or a loss of approximately 65,000 acre-feet of water more each year than would normally be used by the irrigation projects in the entire middle basin. The phreatophyte problem is particularly acute at the head of Lake McMillan where for many years approximately 13,000 acres of salt cedars have effectively retarded like a sieve the sediment as it approaches Lake McMillan, allowing the relatively clear water to pass into the reservoir. In performing this screening function, nature has taken a heavy toll of water. The salt cedars at the head of McMillan are consuming

55,000 acre-feet of water annually in this one spot of the area alone. We estimate that an average annual salvage of 24,500 acre-feet can be expected from construction of the proposed 1,500 cubic feet per second water salvage channel in the McMillan Delta with a cleared floodway. I have recommended to the Texas commissioner that he approve the water-salvage plan even though by mutual agreement the floodway will not be cleared until terminal storage has been provided to offset the loss of capacity in Lake McMillan due to silting which may be caused by clearing this floodway. In determining the capacity required to replace such terminal storage in the Carlsbad district, the computation shall include only the silting which would have resulted from clearing of the floodway and not the silting which may occur from operation of the conveyance channel itself. Cost of the water-salvage program is estimated at $2,161,000. The annual operation and maintenance cost will amount to an estimated $52,800. The two States have agreed to assume jointly the cost of operation and maintenance on an equitable basis.

Another serious problem of the Pecos River, and one with which I have been closely identified, is the salinity problem. During the early part of this century, before storage facilities were provided for Texas, it was difficult to use the water supply of the Pecos River for irrigation due to its poor quality. The only way the quality could be improved in those days was to hope for a flood, which would temporarily dilute the river's high salt content.

When the Red Bluff Reservoir was completed in 1936 the farmers of the district felt that most of their water problems were over. The quality of the river water did not thereafter improve, however, and it was discovered that a large amount of salt was entering the Pecos River at a point about 15 miles upstream from the Red Bluff Reservoir. The brine inflow in this area, the Malaga Bend, has been observed and studied since 1937. In September of that year, three New Mexico water users brought suit against the United States Potash Co. They claimed a pollution of the Pecos River had occurred through escape to the river of salts from the refinery's salt lake-disposal area with resultant injury to the crops and lands of the plaintiffs, and asked for damages in amounts totaling $240,000. Some time previous to the filing of these suits the potash company had offered to cooperate with the farmers in every practicable way through investigations to determine definitely the source of the salinity in the river, and arrangements were completed for a study by the United States Geological Survey in cooperation with the New Mexico State engineer. This study of the ground water and quality of water in the Malaga Bend vicinity was initiated early in 1937 and continued through 1938. During the trial of the suits the results of the study by the Geological Survey were submitted. This study included reports by Howard and White on the quality of water, and by Robinson and Lang on ground water. The latter report described the great body of brine some 200 feet below the surface and the escape of this brine under hydrostatic pressure through the valley fill to the surface at Malaga Bend. This report also expressed the definite opinion that the salt in the river did not come from the waste of the potash company's refinery. The ensuing litigation finally resulted in a verdict in favor of the potash company.

During the period 1939–41 additional studies of this problem area were undertaken within the scope of the work of the National Resources Planning Board in the Pecos River joint investigation. The preceding work by the United States Geological Survey in the potash company suit was continued and possible remedial measures were investigated. The report of the Pecos River joint investigation, dated June 1942, suggests the possibility of diverting this brine and disposing of it by evaporation to prevent its inflow to the river.

During the negotiations of the Pecos River compact that followed the completion of this report, this possibility of river pollution was recognized and provided for.

The Commission, in financial cooperation with the Ground Water, Quality of Water, and Surface Water Branches of the United States Geological Survey, began intensive investigations of this problem of salt pollution in 1951.

On December 27, 1954, Secretary of the Interior McKay released the report of these investigations titled "Possible Improvement of Quality of Water of the Pecos River by Diversion of Brine at Malaga Bend, Eddy County, N. Mex." In his release announcement Secretary McKay noted the Pecos River Commission would reproduce the report.

Data in this report show that brine under a small hydrostatic pressure (varying from 3 to 10 feet) enters the river at a rate of about 200 gallons per minute. The artesian type flow is almost completely saturated with salt. About 420 tons

of dissolved minerals, of which about 370 tons are common salt, are added daily to the mineral load of the Pecos River through seeps and springs along this 3-mile stretch. The river at this point, as the name implies, makes a long, narrow loop. The brine inflow has been shown to be confined to the spring inflow entering the stream in this small area.

Data included in tables appended to the USGS report show that during the 9-year period covered by water years 1945 through 1953 (the latest records available 31 percent of the total dissolved solids passing the Red Bluff (State line) gaging station were contributed in the Malaga Bend area. During the more critical low-water years of 1952 and 1953 37.6 percent and 46 percent, respectively, of the total dissolved solids at the Red Bluff station were added to the stream in the vicinity of the Malaga Bend.

This inflow of salt complicates seriously the irrigation of the district, and the operation of Red Bluff Reservoir. If storage is carried over for the succeeding year's irrigation, then the water held becomes progressively more concentrated by the brine inflow.

The productivity of lands in the Red Bluff district would be greatly increased if the Malaga Bend project were installed.

Tests made by the USGS indicate that the aquifer carrying this solution would transmit and yield water readily to a well, and that the total volume of brine to be pumped would be a rather small item. The USGS investigated the proposal of pumping the brine to a nearby off-channel dry lake known locally as Queens Lake, where the water could be evaporated leaving the salt deposited. The initial rate of pumping would be about 3 times the brine inflow or 600 to 700 gallons per minute. This would continue until the pressure of the brine aquifer was such that it would not be sufficient to raise the brine to the level of the river. Following this initial reduction of pressure the rate of pumping would be gradually reduced until it approximated the natural discharge of the brine or about 200 gallons per minute. The large underground brine reservoir would remain but by reducing its static head this solution would not enter the Pecos River.

I should like to point out that this proposed method has been derived from engineering studies using known ground-water theories. However a search of all available literature fails to show that this method of relief has previously been tried elsewhere.

The engineering advisory committee to the Pecos River Commission has worked very closely with, and received the excellent cooperation of the branches of the United States Geological Survey in making this study. The committee has independently prepared estimates of the initial costs of this project as well as estimates of annual operation, maintenance, and replacement costs. They estimate the initial cost to be $150,000, including in this the costs incident to the final design, the actual construction, the necessary rights-of-way, and the supervision of construction. The annual operation and maintenance costs are estimated at $4,000. A program of evaluation of the effectiveness of the project would be continued by the Pecos River Commission and is not included in these costs.

Senator ANDERSON. If there is no objection, I would like to switch to Bureau of Reclamation witnesses now and come back to the others at a later time, if I could.

Mr. Nielsen, will you state your name.

STATEMENT OF E. G. NIELSEN, ASSISTANT COMMISSIONER, BUREAU OF RECLAMATION

Mr. NIELSEN. I am E. G. Nielsen, Assistant Commissioner of the Bureau of Reclamation. As you know, Mr. Chairman, we appeared also in the House this morning. Mr. Robert Jennings, regional director at Amarillo, is here but stayed in the House so he might answer questions there. He has a prepared statement but I rather suspect that his statement and mine if read in their entirety would cover ground that you have already covered in terms of the physical plan and so on. So I might just submit those statements for the record and make some comments in the interest of saving time.

Senator ANDERSON. Yes. You may submit both the statements of Mr. Jennings and yourself.

Mr. NIELSEN. I am E. G. Nielsen, Assistant Commissioner of the Bureau of Reclamation. I am happy to have the opportunity of expressing Reclamation's views in respect to the legislation before your committee.

The Bureau of Reclamation has long been concerned with the water problems of the Pecos River Basin. We fully endorse the desirability of achieving in the basin all practicable measures to alleviate the critical water shortage condition which now exists there. To this end, the Bureau of Reclamation and the Geological Survey, both Department of the Interior agencies, in close cooperation with the Pecos River Commission and other concerned Pecos River Basin water agencies and interests, conducted investigations which culminated in the reports referred to in the pending legislation.

The Bureau of Reclamation report presents engineering findings with respect to a proposed plan specifically advanced by the Pecos River Commission for construction of a water-salvage channel through the delta area upstream from the existing McMillan Reservoir of the Carlsbad project.

The Bureau's report on the commission's plan does not appraise the repayment ability of the water users, nor does it recommend, either favorably or unfavorably, with respect to construction work considered. However, it concludes, among other things, that the plan would result in salvage of waters which would have a value for irrigation use within the basin of about seven times the annual cost of salvaging such water.

The Secretary of the Interior approved transmittal of the Bureau of Reclamation report to the States of New Mexico and Texas, particularly to ascertain their views on the willingness, and the extent thereof, to participate in the project in terms of repayment, construction, and related aspects, and to Colorado and interested Federal agencies, all in accordance with law and interagency agreement.

The State of Colorado indicated that it had no specific interest in the Pecos River improvements contemplated.

The State of New Mexico generally endorsed the comments of the Pecos River Commission but, in light of adverse effect that construction of the facilities, particularly the floodway, would have upon the future life of the existing McMillan Reservoir of the Carlsbad Irrigation District, recommended that no moneys be appropriated for and no work be commenced on the clearing of the floodway until certain problems affecting operation of the Carlsbad project have been satisfactorily resolved.

The State of Texas endorsed the plan and concurred in the desires of local interests for temporary deferment for clearing of the floodway.

No adverse comments were received as a result of transmittal of the report to the interested Federal agencies.

The Pecos River Commission endorsed the findings of the Bureau of Reclamation and proposed that the Bureau construct the water salvage channel conforming with the plan described in the Bureau's report.

The commission advanced the opinion that the States of New Mexico and Texas would be able to acquire the necessary rights-of-way, make

the necessary highway relocation, construct necessary bridges, and construct one of the access roads for the water-salvage channel. All of this was considered to involve about $289,000 of the estimated water-salvage channel cost of $2,161,000. The commission further advanced its belief that the maintenance and operation of the water-salvage channel and the salinity alleviation program would be undertaken by appropriate State agencies in conjunction with the local interests. The commission expressed the viewpoint that the national interest is such that all costs other than those should be nonreimbursable.

The two States, New Mexico and Texas, have indicated that the commission's views express their position in respect to participation in the proposed project.

In view thereof, the Bureau of Reclamation recommended in its final report to the Secretary that its proposed report, together with the comments received from the States and Federal agencies, be transmitted to the President and the Congress for their information and appropriate consideration. The Secretary's approval thereof and transmittal of the Bureau's report to the President was accomplished on February 14, 1956.

Mr. Robert W. Jennings, regional director at Amarillo, Tex., and Mr. Ralph Charles of the Albuquerque project office are here to present detailed information concerning the Bureau's investigations and planning report.

STATEMENT OF ROBERT W. JENNINGS, REGIONAL DIRECTOR, REGION 5, BUREAU OF RECLAMATION

Mr. JENNINGS. I am Robert W. Jennings, regional director of region 5 of the Bureau of Reclamation, with offices in Amarillo, Tex.

I should like to summarize briefly the history of the irrigation in the Pecos River Basin in New Mexico and Texas, and Bureau of Reclamation consideration of water-salvage measures in the interest of such irrigation.

Irrigation in the Pecos Basin dates back to the systems of the Pueblo Indians found by the Spanish explorers in 1540. In the upper reaches where the stream is largely snow and spring fed, irrigation is accomplished by direct diversion. In the middle and lower reaches, where runoff is largely due to extremely erratic rainfall, regulatory storage is necessary, and irrigation is limited by the available water supplies.

By 1893 irrigation had become of significance in the economy of the middle and lower reaches of the Pecos Basin. Private interests had constructed what is now the Carlsbad irrigation project in the vicinity of Carlsbad, N. Mex. In 1893 heavy rains and resulting floods seriously damaged the storage reservoirs and diversion works of the project. These were restored at considerable financial strain but in 1904 severe floods again damaged the irrigation works, including destruction of Avalon Dam and heavy sedimentation of McMillan Reservoir. These damages and the financial inability of the irrigation company to make repairs led to a movement for rehabilitation of the project by the United States Reclamation Service.

In 1906, about the time of development under private enterprise of the upstream Fort Sumner irrigation district, the Reclamation Serv-

ice (now the Bureau of Reclamation) took over operation of the Carlsbad project in an effort to help the few remaining farmers and save as much of the project development as possible. Substantial improvements costing more than $1 million were made in the succeeding years, including the reconstruction of Avalon Dam and enlargement of McMillan Reservoir.

A third reservoir was provided for the project in 1938 by the construction of the Alamogordo Dam at a cost of more than $2 million. The present works are capable of delivering water to the 25,055 acres of irrigable land.

In the meantime, the upstream Fort Sumner development had experienced troubles comparable to those which had been faced by the Carlsbad Irrigation District until it also became in hazardous condition financially and undertook steps to obtain the assistance of the Bureau of Reclamation in rehabilitation of its works.

About 1936 construction of the Red Bluff Reservoir, near the Texas-New Mexico line on the Pecos River, had provided for the development of about 40,000 acres under irrigation in the vicinity of Pecos, Tex.

Because of the water shortage problems for these projects the Secretary of the Interior, in 1939, requested the National Resources Planning Board to make a comprehensive investigation of the Pecos River Basin. The report of the Board entitled "Report of the Pecos Joint Investigations" was published in 1942, and presented a comprehensive analysis of the water supplies and water problems of the basin, but presented no conclusions or recommendations. It emphasized the growth of salt cedars in the delta area upstream from the McMillan Reservoir, as well as elsewhere in the basin, and the resulting large nonbeneficial consumption of water. To indicate the extent of this problem, the Pecos River Commission estimated that in 1953, 36,270 acres of salt cedar infested area existed between Alamogordo and McMillan Dams. Of this, about 14,000 acres are in the McMillan Delta area. The report also pointed out the adverse effect on water supplies in the lower portion of the basin of the salt inflows in the vicinity of Malaga Bend.

At about the same time operation of the Red Bluff irrigation project had established that water supplies from the Red Bluff Reservoir were of such poor quality and so deficient in quantity as to preclude irrigation of the acreage for which works had been constructed.

In 1949 the Pecos River Compact, which provides for diversion of the Pecos River flows between New Mexico and Texas was negotiated. The compact, to which the Congress gave its consent by Public Law 91 in the 81st Congress, provides under article 4, among other things, as follows:

> (*a*) New Mexico and Texas shall cooperate to support legislation for the authorization and construction of projects to eliminate nonbeneficial consumption of water.
>
> (*b*) New Mexico and Texas shall cooperate with agencies of the United States to devise and effectuate means of alleviating the salinity conditions of the Pecos River.

During the late 1940's the Bureau of Reclamation, at the request of the local interests, investigated the need for rehabilitation of the Fort Sumner and Carlsbad projects. These investigations culminated in the preparation of a planning report dated January 1947 on "Plan of Rehabilitation for the Fort Sumner Project," and a report dated De-

cember 1950 entitled "Plans for Rehabilitation of the Carlsbad Project and for Water Salvage Measures in the Pecos River Basin, N. Mex."

Rehabilitation of the Fort Sumner project was completed in 1952 by the Bureau of Reclamation in accordance with a congressional authorization of that project passed in 1949.

The report on the Carlsbad project was presented to the Pecos River Commission, an interstate administrative agency created by the Pecos River compact, and to the Carlsbad Irrigation District in 1951. The district undertook the proposed rehabilitation of the Carlsbad project works with its own organization. It also undertook construction of a channel along the east side of the McMillan Delta for the purpose of delivering the low flows of the Pecos through the delta area into the McMillan Reservoir. In light of the actions by the Carlsbad Irrigation District, processing of the Bureau's report was deferred.

The Pecos River Commission, after reviewing the Bureau's plan for bypassing the normal flows of the Pecos River around the west side of the McMillan Delta, concluded that it would be of greater benefit to expedite flows through the delta in spite of the increased sedimentation it would cause in McMillan Reservoir. The Bureau of Reclamation, therefore, in coordination with the Pecos River Commission, undertook an engineering study of the commission's proposal. This resulted in our report entitled "Plan for McMillan Delta Water Salvage Channel, Pecos River Basin, N. Mex.," which the Secretary approved on June 13, 1955. This is the report referred to in the legislation under consideration.

The principal features of the plan advanced by the Commission consist of a channel heading structure, located at a point about 3 miles northeast of Artesia, a low-flow conveyance channel, a floodway levee, and a cleared floodway extending from the heading southward through the delta into McMillan Reservoir, a distance of some 16 miles. The capacity of the channel would be 1,500 cubic feet per second; that of the floodway, 40,000 cubic feet per second.

Normally, all river flows up to 1,500 cubic feet per second would be carried in the conveyance channel. During periods of higher river flow, the amount admitted to the channel could be regulated by the gated heading structure and the remaining flow diverted into the floodway. When diversion into the floodway occurs, the temporary dike at the head of the floodway will be overtopped and breached. Upon recession of the flows, the temporary dike will be reconstructed. The irrigation releases from Alamogordo Reservoir will be coordinated with river flows at Artesia in order to minimize the occasions upon which combined river flows and reservoir releases exceed conveyance channel capacity.

Controlling growth of salt cedars is expected to be the chief maintenance problem in the floodway. The proposed plan contemplates airplane spraying of the floodway with chemicals. The spraying schedule would be coordinated with nearby farming operations so that crops will not be damaged. Ground spraying or control by mechanical means can be resorted to if necessary.

Maintenance of the heading structure is expected to consist chiefly of replacing the temporary dike section across the head of the floodway after it has been breached by floods. Major repairs must be made in the event of floods greater than the design capacity of the project. In view of the probability of such floods, the plan for main-

tenance provides for replacing one-third of the levee and conveyance channel once every 25 years.

The cost of construction of the water salvage channel was estimated on the basis of September 1954 prices to total $2,161,000.

The average long-time annual operation and maintenance costs are estimated to total about $53,000; at 1954 prices, these costs are estimated at about $80,000.

The project studies indicate that the average annual salvage of water now nonbeneficially consumed in the McMillan Delta are through construction of the facilities proposed in our report would be about 24,000 acre-feet. This would represent the net increase of the usable basin water supplies available to both New Mexico and Texas, and it would be distributed between those States in accordance with the appropriate provisions of the Pecos River compact.

Our studies indicated that passage of the Pecos flows through the McMillan Delta area, as contemplated under the plan, would result in increased rate of sediment inflow to McMillan Reservoir which would result in a net loss of reservoir capacity attributable to the water salvage channel of about 21,400 acre-feet over the estimated 36-year period required to fill the storage capacity which remains available in that reservoir.

The pending legislation would provide for slight modifications of the plan advanced in our report through deferral of the floodway clearing and construction of spur drains. If the floodway is not cleared, redesign of the levee system would be necessary in order to provide an adequate degree of protection to the channel. This also would result in reducing the estimated annual water salvage from 24,000 acre-feet to 17,000 acre-feet. To provide for this change in plan, as well as the spur drains, it appears desirable that the joint resolutions be amended to permit the Secretary of the Interior to make such revisions in the design of the facilities as necessary to carry out the purpose of the project.

Payment capacity of the irrigators in New Mexico and Texas which might be available for repayment of the construction cost of the water salvage channel was not evaluated by the Bureau in its report on engineering findings. However, it is pertinent to recognize in considering the pending legislation that the water salvage channel would simply make available again for beneficial consumptive use Pecos River flows which once were utilized for irrigation in the basin.

The present payment capacity of the Carlsbad Irrigation District lands is required to meet the outstanding obligations of the district and the current rehabilitation program. Both the Carlsbad Irrigation District and the Red Bluff District have been sorely pressed during the recent and continuing drought in the Pecos River Basin to the extent that they have had to curtail irrigation of their respective district lands.

The Pecos River Commission advanced the opinion that the States of New Mexico and Texas would be able to acquire the necessary rights-of-way, make the necessary highway relocation, construct necessary bridges, and construct one of the access roads for the water salvage channel. All of this was considered to involve about $289,000 of the estimated water salvage channel cost of $2,161,000.

The commission further advanced its belief that maintenance and operation of the water salvage channel—and, we assume, the floodway

levees—and the salinity alleviation program would be undertaken by appropriate State agencies in conjunction with the local interests. The commission expressed the viewpoint that the national interest is such that all costs other than those should be nonreimbursable. The States have indicated that the commission's views express their position in respect to participation in the proposed project.

It is our viewpoint that, should the pending legislation be passed with the amendments suggested above, appropriate modifications in the plan of development to provide for construction of the desired spur drains and redesign of water salvage channel and levee system to provide an adequate degree of protection therefor, could be accomplished as part of the reconstruction activities of the authorized project.

It is apparent that the tremendous and urgent need for additional water supplies within the Peros River Basin and the value of water for irrigation use in that basin make desirable the undertaking of all practicable measures to permit fullest beneficial use of the limited Pecos River Basin water supplies.

I thank you for this opportunity to explain the engineering findings of our agency. Mr. Ralph Charles, of our Albuquerque project office, and I will be glad to furnish additional details if you so desire.

Senator ANDERSON. I am particularly anxious to hear you state whether or not you believe this salvage project will be effective in providing additional water for the river, and I will ask you also to state whether you believe the attempt to get rid of the salts in the Malaga Bend area will be useful to our neighbors and friends.

Mr. NIELSEN. As you know, the Secretary has not yet set up a report on the joint resolution.

Senator ANDERSON. You see no impropriety in your testifying, do you?

Mr. NIELSEN. No. This is not a typical reclamation project in that, as we developed these plans with the Pecos River Commission—and I think it is a fine example of joint State-Federal operation, incidentally—we did not go into the repayment implications of this. We tried to correlate with the commission as to its proposals. We discussed, however, as we developed the physical plan that water could be salvaged of value about seven times the cost of salvaging that water. So in terms of getting to your immediate question, certainly there are real values in the salvage of this water.

As to the salinity abatement development downstream, that was investigated in detail by the Geological Survey. We don't know the details. Anyone involved in irrigation knows that the Red Bluff District just cannot live long or economically with the kind of salts that are coming into the river, particularly at low flows. There should not be any question at all about any economical means of getting rid of those salts being feasible and justifiable.

Senator ANDERSON. As a longtime engineer—and I have had your testimony many times before this committee—does your engineering experience check with the statements made that when the water supply drops and the brine flow remains at a high level, it is far more destructive than when the water supply is normal, because the salt concentration is proportionately stronger when periods of drought continue?

Mr. NIELSEN. That is true.

Senator ANDERSON. We have been having those periods of drought, have we not?

Mr. NIELSEN. That is right.

Senator ANDERSON. We do need to do two things: One of them is that we need to increase the flow of water in order to reduce the potency of this brine. Now regarding the second thing, the statement was made that much of the salt comes into the river from artesian flows.

Mr. NIELSEN. If we can relieve that artesian pressure we will alleviate the problem.

Senator ANDERSON. From your standpoint as an engineer you like that part of the project?

Mr. NIELSEN. Yes, very much.

The resolution goes to the authorization of certain specific works, all in accordance with the report of the Pecos River Commission, which includes the Bureau's report. There are some differences between the works proposed under this legislation and the report. The proposed legislation would alter the floodway channel by providing that no clearing shall be accomplished until certain other work precedes the clearing. Obviously if the floodway is not cleared the velocity of floodwater through the floodway channel will be slower, which means we must have a greater depth. So there is some implication toward the height of levees. Some minor redesign should be accomplished if clearing is not to be had.

The legislation is specifically as to spur drains, and the witnesses have testified on spur drains. The spur drains were not in the report. I call this to your attention for two reasons. One is that our estimate of course cannot be absolute because we didn't estimate on the basis of the plan of the legislation. It is not serious in my judgment, but there is that difference.

Secondly, I think that the legislation ought perhaps to spell out the ability of the Secretary of the Interior to so alter his plan as to accommodate the intent of the reports and allow him to use judgment as to modification of the plan. That is general in our legislation.

One more point: I think possibly through an inadvertence the report and the bill doesn't make it entirely clear that it is the intent, as I think it is, of the sponsors of the legislation that the Federal Government be relieved of any operation and maintenance costs of floodway and the levees. I don't think there is an argument there, but I think it ought to be made clear.

I will be glad to answer any questions. That briefly supplements what I assume to be previous testimony. I understand our full statements will appear in the record.

Mr. LINEWEAVER. Mr. Nielsen, is there any information as to when the report of the Department will be available?

Mr. NIELSEN. No, I don't have that information, Mr. Lineweaver.

Mr. LINEWEAVER. It is my understanding that it has gone to the Bureau of the Budget, is that correct?

Mr. NIELSEN. That is my understanding.

Mr. LINEWEAVER. Are there any other witnesses from the Bureau?

Mr. NIELSEN. Not unless you want to ask further questions. If you do, Mr. Charles is here with me, and he probably could better answer them.

Mr. LINEWEAVER. There are no further questions of the Bureau unless you and Mr. Charles have some more statements to make.

Senator LAIRD (presiding). Mr. Lowry, will you state your name for the record, please?

STATEMENT OF ROBERT L. LOWRY, CONSULTING ENGINEER, AUSTIN, TEX., ENGINEER ADVISER TO PECOS RIVER COMMISSIONER FOR TEXAS

Mr. LOWRY. I am Robert L. Lowry, consulting engineer from Austin, Tex. I have been intimately connected with the Pecos and acquainted with its problems for the last 15 or 16 years. I went out there as a hydraulic engineer for the National Resources Planning Board in 1939 when they started the Pacos River investigation and most of the time since then I have been connected with it in some capacity.

Before I go to my statement, I would like to submit for your information two sets of area photographs which were made of the area immediately upstream from Lake McMillan. There is a key map which shows the approximate location. They are identified on the back.

(Photographs filed with committee.)

Mr. LOWRY. The two sets were taken approximately 6 weeks apart following a small flood which occurred in that area last year. The first set was taken around the 1st of October and shows the water impounded when it once left the channel due to being stopped there by the deterioration of the channel and spreading over the area which has been infested with the salt cedars.

The second set of pictures, taken about the middle of November, shows that that water is still largely in the same place. It has not drained out in any manner sufficient to indicate that it is draining through there.

That shows what happens to the water once it gets out into the salt cedars on that delta area.

I have prepared a statement which it probably would take about 20 minutes to read. If it is your wish, I will do so or, if it would be acceptable, I will try to brief it and cut the time as short as we could in the interest of time.

Senator LAIRD. Very well.

Mr. LOWRY. While there is some detail given in the statement and I presume that will be made a part of the record, I want to refer to only two particular problems of Pecos River. As you have already heard from other witnesses, there are many problems associated with the Pecos, probably as many in that one small stream as there are in most other even large streams in our country.

But there are two of those problems about which it is our feeling that we can do something now to get some relief. One of those is in regard to salvaging some water now nonbeneficially used by the native vegetation, mostly made up of salt cedar. I would like to describe that situation so you can see what is happening on the river and what has brought about the situation in which now we find ourselves.

The first salt cedars that were first noticed out there were about 1915. At that time they appeared on the delta at the head of Lake McMillan. They started a chain reaction which has since that time

been going on. As they grew and developed, they were sufficiently thick and caused enough obstruction to the flow of water that the velocity was checked and the silt which was held in suspension was immediately dropped and built up the delta.

That delta, composed of these rich alluvial deposits, proved a very acceptable place for the salt cedars to spread, and they took over. They immediately spread to the new delta as it formed. That process is still going on.

Aerial surveys which have been made in the past 15 years, of which there is a series of about 3 that we can date, have indicated that the salt cedars are now expanding at the average rate of about 1,600 acres per year. In 1951 we made our most elaborate survey and got the most detail. That was followed by a detailed survey in the office in which all the water-using areas were delineated. That in turn was checked by field reconnaissance. At that time we found that the area covered by salt cedars along the river from the Texas-New Mexico State line to the Alamagordo Dam some 240 or 250 miles upstream was about 32,000 acres and expanding at the rate of about 1,600 acres per year, since that time, it is indicated that there are approximately 40,000 acres of that vegetation now along the river.

In most areas along the river these form a simple fringe where the roots tap the ground water which is provided by the river, but in one area, notably on the delta at the head of Lake McMillan, they are concentrated to where they now cover an area which is between 15 and 20 miles long and varies from 1 to several miles wide, in which there is an estimated area of about 15,000 acres in that 1 body.

It is through this area that we think our chances of affording some relief are the best and that is the area that is aimed at in the project which has been submitted to you.

As a result of that project we hope to salvage water which will be of an appreciable amount. Any water that we do salvage will be very beneficial, because from that point on the river, down through this series of dry years, there has been a very inadequate water supply.

I would like to call to your attention that the water that we are trying to salvage is not new water, but it is water which was once available to the irrigators along the river, and only through the process of nature have they been deprived of it. It was not man's doing but nature has interfered. We are trying to get that water back into the hands of man. That is what the project consists of.

I don't know how much has gone on heretofore in the previous testimoney about the other problem that is peculiar to a certain strip of the Pecos. That is in regard to the salinity that enters the river in the Malaga Bend area, which is about 15 miles above the head of the reservoir from which Texas gets its storage for irrigation from the Pecos in Texas. In that particular area it has been found by the Geological Survey which has been studying that area for about 15 years that there is a sea of brine confined in the underlying strata and the river has cut through them and allowed cracks to appear, which, because of the hydrostatic pressure and the artesian pressure below are pushing that brine up into the river. It is estimated that only about a half a second-foot of water is involved, but that water is so saturated with brine that the concentration of salt is in the terms of about 150,000 parts per million, which roughly is 4 times the salinity concentration of sea water.

That water, only a half second-foot, is producing in the river each day about 420 tons of dissolved minerals. Of that 420 tons, about 370 tons are pure salt, which means nearly 90 percent of the dissolved solids is pure salt, just like we see on the table. In the tests which were made we pumped that water out, and it crystallized on the outlet pipes of the pump and formed pure salt crystals. It is that pure.

You could go out there and break them off and carry them away with you. It is of that consistency.

The plans for relief from that is to put a production well down into the area some 200 to 400 feet deep, which will tap these salt brines which are under pressure and pump at a rate which will reduce that pressure to where the inflow which is being pushed up from below will cease to be pushed out into the river. It has nothing to do with the river water which is passing that point which will go on as it is, but it would keep from adding to it at that point this 420 tons a day of additional salt load.

It is that which we think justifies the project, if we can keep that much salt out of the Red Bluff area or Red Bluff Reservoir.

Incidentally, that 370 tons of salt a day, if you care to think of it in terms of a year, amounts to about 135,000 tons of salt. Any way you look at it, that is just lots of salt.

With your permission I will not take further time, but if there are any questions I can answer I will be glad to try.

Senator LAIRD. That is all. Thank you, sir.

(Mr. Lowry's prepared statement follows:)

STATEMENT OF ROBERT L. LOWRY, ENGINEER ADVISER TO THE PECOS RIVER COMMISSIONER FOR TEXAS

I am Robert L. Lowry, now a consulting engineer of Austin, Tex. Since the time of the Pecos River joint investigation I have been quite intimately acquainted with the Pecos River and its problems throughout its course. I was hydraulic engineer for the Pecos River joint investigation for nearly 2 years, with headquarters in Roswell, N. Mex., where, working under the direction of Harlowe M. Stafford, I made the hydraulic studies that were reported upon by the National Resources Planning Board under the title of "Regional Planning, Part X—Pecos River Basin, June 1942."

Efforts to arrive at a compact between the States of Texas and New Mexico date back about 35 to 40 years. When a new Pecos River Compact Commission was appointed in December 1942 following the completion of the Pecos River joint investigation, one of the first acts of this commission was the formation of an engineering advisory committee (in 1947) with instructions to prepare detailed hydrologic studies for the basin, upon which it was hoped that a compact might be based. I was the engineer for the State of Texas on the engineering advisory committee, and a member of the subcommittee that prepared these studies. In this capacity I participated in the negotiations of the compact. Since the compact was agreed upon in 1948, I have been one of the technical advisers to the Pecos River commissioner for Texas. I appear before you in support of the above-named projects.

Mr. Tipton has given you a general picture of the Pecos River, its problems, and some of the complications which make their solution difficult. It is my purpose to point out some of the most aggravating of the problems, particularly those about which there is some hope for relief; to describe these in somewhat more detail than Mr. Tipton has done; and to present to you a discussion of the means by which these remedial measures can be accomplished.

There are a number of problems common to the basin that result from the location of the river in an arid section of the great Southwest, where the opportunities for relief are almost nonexistent. On the other hand, there are two problems, which because of their local concentration and characteristics, can be attacked along the lines proposed in the projects here under consideration.

There is every reason to believe that some measure of relief can be obtained as a result of the construction of these projects. These two problems can be described as losses due to nonbeneficial uses of river water by native vegetation, and the poor quality of the water in the river due to a peculiar natural salt input.

One of the major problems subject to remedial measures consists of large nonbeneficial uses of water from the river by native vegetation. This problem in the Pecos River Basin has resulted from the spread of salt cedars. These are plants of the Tamarisk family (Tamarix gallica), which require a greater amount of water than is needed by the usual desert shrubs and grasses that are prevalent in this basin.

Salt cedars were first noticed in the Pecos River Basin in 1915, when they were found propagating on the delta at the head of Lake McMillan. In the forty-odd years that have elapsed since that time they have spread both up and downstream to where the channel is now affected from above Alamogordo Reservoir to far below the State line into Texas. In some reaches of the river there is only a fringe of salt cedars along the channel, while in other areas, more favorable to their growth, the salt cedars have spread laterally to cover a vast area. This is notably true of the Lake McMillan Delta, where these high water-using plants now cover an area of aproximately 15,000 acres.

An aerial survey was made by the Pecos River Commission of the water-using areas along the Pecos River during the winter season of 1950–51, which extended from the headwaters to the Texas-New Mexico State line. Detailed maps were prepared from the aerial photographs showing the lands along the river that were using water from the river—whether artificially applied as irrigation water, or as drawn from the river by native vegetation along the channel. All areas using water from the river were classified as to use, with the details being checked by a field reconnaissance wherever any doubts existed. The 1950–51 survey showed a total area of 32,000 acres along the Pecos River in New Mexico below Alamogordo Dam that were covered by high-rate water-using plants of native vegetation. Almost all of this type vegetation is saltcedars. Earlier aerial photographs taken during the progress of the Pecos River joint investigation in 1939–40, and for an oil exploration survey in 1946, were made available for comparison, and a determination of the areas similarly affected by saltcedars on those dates was made. The information gained from these earlier photographs permits an analysis of the rate of expansion of these saltcedars. All of the information on the acreage covered by the saltcedars at various times is portrayed graphically by the curve on exhibit 4 of the report of the Pecos River Commission titled, "Initial Development, Water Salvage and Salinity Alleviation Action Programs, Pecos River Basin, February 1955." From the information obtained as a result of the aerial surveys, it is apparent that the present rate of expansion of the saltcedars along the Pecos River in New Mexico is about 1,600 acres per year. There has thus been an additional area of about 8,000 acres covered by this native vegetation since the last survey was completed. This makes a total area of 40,000 acres presently affected by the saltcedars between Alamogordo Dam and the Texas-New Mexico State line.

Such an area, extending from the Alamogordo Dam to the State line, exceeds the area now subject to irrigation from the Pecos River within this same reach. Records show the acreage presently irrigated (under 1947 conditions) from the river to be as follows:

	Acres
Fort Sumner project	6,500
Legal pumpers above Artesia	5,000
Carlsbad project	25,000
Independent operators below Carlsbad	2,400
Total irrigated area	38,900

Long-time average requirements for irrigation in terms of headgate diversions, based on past records for these areas are about as follows:

	Acre-feet
Fort Sumner project	30,000
Legal pumpers above Artesia	8,800
Carlsbad project	130,000
Independent operators below Carlsbad	6,600
Total headgate diversions	175,400

Experiments and actual field data have shown conclusively that as much water as 6 acre-feet per acre will be consumed annually by caltcedars whenever they grow within reach of the water from the river. While the beneficial uses shown above, and those in Texas, have not had sufficient water to meet their requirements the saltcedars, taking water at the rate of 6 acre-feet per acre annually, would be consuming approximately 240,000 acre-feet of water from the river each year if the water were available. It may thus be noted that the saltcedars are now probably using about 65,000 acre-feet per year more than is beneficially used by all irrigation from the river in the reach from Alamogordo Dam to the Texas-New Mexico State line.

As previously noted, this area of 40,000 acres now covered by saltcedars extends along the river all the way from Alamogordo Dam to the Texas-New Mexico State line. There is one area, however, in which the infestation of the saltcedars is concentrated, and that is at the head of Lake McMillan. This delta, extending from United States Highway 380, east of Artesia, N. Mex., to the McMillan Reservoir, contains an area of 15,000 acres. Not only is this the largest concentration with respect to area, but the average density of the saltcedars here is greater than that found elsewhere along the river.

The first saltcedars were at the head of Lake McMillan as it was in 1915. As these saltcedars grew and the density increased, they formed an effective barrier to the free passage of water into the reservoir. This started a chain reaction that is still in progress. Each flood that came down the river spread out into the saltcedars at the head of the reservoir. The decrease in velocity of the water as it moved through the saltcedars was sufficient to cause the silt in suspension to be released. As a consequence the delta began to move upstream. The wide expanse of fertile soil, added to by each successive flood, proved to be a highly favorable spot for the growth of saltcedars. With the passing of time this process of silt deposition—followed by expansion of the saltcedars—was repeated innumerable times. The result, with the end not in sight, is that the saltcedars have caused the delta to be built up, completely obliterating the former channel for many miles.

An example of the large losses of water that regularly occur in this delta can be seen on exhibit 7 of the Pecos River Commission's report. A small flood that came down the Pecos River in May 1954, originated above the Lake Arthur gaging station (about 15 river miles upstream from the Artesia gage). The volume of this flood as it passed the Lake Arthur gaging station was about 21,400 acre-feet. Normal irrigation diversions to a few irrigated areas, and a slight channel loss occurred between this gaging station and the Artesia gage. There are no beneficial uses of the river water along the channel between the Artesia gaging station and the Kaiser Channel gage, yet 51 percent of the flow passing the Artesia gage was lost in this reach, which is no longer than the reach above in which its losses were rather low.

This area, in which the heavy concentration of saltcedars occurs, is the area most susceptible to recovery of water by a water salvage project. During the Pecos River joint investigation a possible increase to the basin water supply by the elimination of the saltcedars in the Lake McMillan Delta was envisioned. However, no solution to this problem was evolved at that time. The concept of a water-salvage program, and the benefits to be derived from such a program, were specifically made a part of the negotiations, and were then embodied in the text of the Pecos River compact. Since the compact became effective in 1949, the Pecos River Commission has been working continuously toward getting a salvage program in the delta area into operation.

The United States Bureau of Reclamation, reporting upon a plan for the proposed rehabilitation of the Carlsbad project in 1950, included a provision for the construction of a channel around the saltcedars along the western edge of the valley. This channel had a proposed capacity of 1,500 cubic feet per second capable of carrying all of the ordinary flow of the river, plus the releases of irrigation water from Alamogordo Reservoir. Flood flows in excess of the capacity of the bypass canal would break over into the saltcedar area on the delta and meander on into the McMillan Reservoir or be lost.

The Engineering Advisory Committee to the Pecos River Commission, after studying this proposal, took the position that while such a channel would have local benefits, much broader benefits could be obtained from a combined conveyance and drainage channel, located through the mid-delta area, together with a cleared floodway through the delta. This type of channel would transport the low-river flows and releases from Alamogordo Reservoir with minimum losses, lower the water table throughout much of the area, and shorten the course of

flood flows across the length of the delta. Losses on flood flows would be materially less than could be expected from the previous plan of the Bureau of Reclamation. Through this reduction in the flood losses, plus depriving the saltcedars of a part of their natural requirements by lowering the water table, a much greater salvage of water could be accomplished.

Working on the above suggested plan, the Bureau of Reclamation has prepared another report which shows the advantages of such a plan. This report titled, "Plan for McMillan Delta Water Salvage Channel, Pecos River Basin, New Mexico," dated November 1954, has also been published without appendixes in the report of the Pecos River Commission entitled, "Initial Development, Water Salvage and Salinity Alleviation Action Programs, Pecos River Basin," dated February 1955. The engineering advisory committee to the Pecos River Commission worked very closely with the Bureau of Reclamation in the preparation of the plan for this water-salvage project.

The water-salvage plan as proposed by the Bureau of Reclamation calls for the construction of a low-flow channel through the delta area with a capacity of 1,500 cubic feet per second, designed to carry the normal flow, releases of irrigation water from Alamogordo Reservoir, and small flash floods. The floodway was to be cleared to provide a passageway approximately 2,000 feet wide for the larger floods. This plan in its entirety was recommended by the engineering advisory committee, and subsequently approved by the Pecos River Commission. The Carlsbad Irrigation District objected to the clearing of the floodway, however, claiming it might result in loss of storage in McMillan Reservoir through siltation. As a result of their objections it was agreed that no money would be appropriated for and no work commenced on the clearing of the floodway until provision shall have been made to replace any terminal storage of the district which might be lost by such clearing of the floodway. This agreement does not alter the plan for water salvage as originally proposed, but does permit it to be accomplished in stages with the clearing of the floodway being deferred. The engineering advisory committee studied the effects of deferring the clearing of the floodway and concluded that the benefits to be derived from the remainder of the program were sufficient to justify going ahead with the other parts of the program. I concurred and so recommended to the Pecos River commissioner for Texas.

Terminal storage as above used, may be defined as storage capacity, as near the point of diversion for the Carlsbad Irrigation District as possible, sufficient to reregulate and control any waters released from their upstream storage at Alamogordo Reservoir, and a part of the floodwaters that originate between the upper and lower points of storage. This terminal storage is presently provided by Lake McMillan. The capacity required and the means of obtaining it are both being investigated by the United States Bureau of Reclamation in cooperation with the commission.

The spur drains, which are provided as a part of the water salvage program consist of a number of lateral drains emptying into the main conveyance channel, or such other main drains as may be provided. These laterals in the drainage system would be so located as to provide drainage to all parts of the delta, where under present conditions large losses of water occur as the result of evaporation from the water surfaces. The idea of these spur drains is not new, it having been considered as an essential part of the plan by the engineering advisory committee for some time. A part of the system will be necessary to drain extensive parts of the area before heavy construction equipment can be brought into the area for the construction of the main channel and the floodway levee.

The basic hydrology of this project is entirely sound from an engineering standpoint. The engineering advisory committee and the Bureau of Reclamation are in agreement on the estimates of the amount of water that can be salvaged under this proposal. The studies show that an average annual salvage of 24,500 acre-feet can be expected.

I wish to point out that the water so salvaged is not new water that can now be made available. It is water which was formerly available, but, due to its interception by native vegetation, it has been lost to irrigation for a number of years. Both the Carlsbad District in New Mexico and the Red Bluff District in Texas would profit by its return to the river.

The other major problem incident to the waters of the Pecos River is in regard to the quality of the water. The waters of the Pecos River are salty, becoming progressively more so in relation to the distance from the headwaters. Salt has many useful purposes to mankind. However, irrigation does not thrive

under salty water conditions. Most crops have their growth retarded or completely stopped if the concentration of dissolved minerals in the water to be applied becomes too high, and particularly so if the dissolved minerals are sodium chloride.

The Pecos River Valley overlies a thick bed of salt in various forms after it once leaves the canyon sections in the mountains. As a result the Pecos River has always been a stream containing a high content of salt, which is natural when there is taken into consideration the fact that surface runoff picks up the salts that are exposed on top of the soils and all ground water brings with it the minerals picked up in solution as it reaches the river by subterranean routes. Although salts are continuously being carried out of the basin at the lower end of the river, the content of the water rarely improves, because salt is being continually brought into the upper reaches of the river. In the lower part of this basin as long as there is water, there will be salt in it. The salt concentration increases in times of low flow, and is diluted during times of flood. There is an inverse relationship between the salt concentration and the crop yields whenever this water is used for irrigation.

During the early part of this century, before storage facilities had been provided to serve the lands irrigated in Texas, the low flows of the stream posed quite a problem. Little use could be made of the stream's salty low flow, and waiting for the infrequent floods to bring in better water was not sufficient for the production of high crop yields. Following the completion of Red Bluff Reservoir in 1936 and its initial filling in 1937, it was thought that the problem of quality of water would be minimized. However, such was not the case.

Subsequent investigations have disclosed that one of the main sources of salt inflow to the lower river can be isolated. It was found that a big part of the salt inflow to the Pecos River occurs in the Malaga Bend in southern New Mexico. Accretions to the river in a 3-mile stretch in this area are provided by a small spring flow where a saturated brine is brought to the surface by artesian pressure to produce about 420 tons of dissolved solids per day. Out of this quantity of 420 tons per day, there are 370 tons of common salt. Since this brine inflow enters the river only a short distance upstream from the head of Red Bluff Reservoir, obviously all of this salt is brought into that reservoir. Some idea of the magnitude of this salt input to Red Bluff Reservoir can be seen when it is realized that 370 tons per day is equivalent to about 135,000 tons per year, which means that from this source alone there is a salt input of about 3 tons per acre for each acre irrigated under the Red Bluff District in Texas.

Investigations begun as early as 1937 by the Ground Water Branch of the United States Geological Survey, and carried on in much greater detail by the Pecos River Commission and the United States Geological Survey during the period 1951 through 1954, have demonstrated that theoretical feasibility of stopping almost completely this inflow of brine to the river. The physical condition is that there is a sea of brine confined under pressure by the rock strata through which the Pecos River has cut its channel in this immediate area. Leaks in this confining strata now permit the escape upward of the brine into the river. It has been the theory of the engineers familiar with the problem that by pumping from this brine aquifer the hydrostatic pressure could be sufficiently reduced so that the brine springs would cease to flow.

Actual pumping tests made on an observation well in the Malaga Bend area during 1953 and 1954 indicated an almost immediate reduction in the hydrostatic pressures at numerous observation points in and around the Malaga Bend due to this pumping from the brine aquifer. The pumping tests were neither continued for an extended period, nor were they at a large rate. These tests were not intended to reduce the hydrostatic pressure enough to stop the brine inflow to the river, but rather to furnish data to indicate whether this procedure might be applicable to the conditions that prevail in the Malaga Bend, and, if so, whether the method would be practicable.

The results of this series of pumping tests show conclusively that it is entirely practical to reduce the pressure on the brine aquifer to accomplish the results desired. The project for the allevation of this salinity problem is before you your consideration at this time.

Essentially, the project consists of reducing the hydrostatic pressure on the brine aquefier by pumping the brine to an off-channel dry lake, known locally as Queen Lake, and permitting the water to evaporate while the salt is deposited in the lake bed. The amount of brine pumped at the beginning of the project would be about 1,200 acre-feet per year. After the pressure has once been

lowered over the brine aquifer the pumping would gradually be reduced to about 400 acre-feet per year. These small amounts of water would have no significant effect on the State line water supply. By having a better quality of water at the State line the actual area that could be irrigated would be greater than could be irrigated with the poorer quality of water.

Mr. LINEWEAVER. The next witness is R. M. Dixon, chairman of the State Board of Water Engineers of Texas.

STATEMENT OF R. M. DIXON, CHAIRMAN, TEXAS BOARD OF WATER ENGINEERS, AUSTIN, TEX.

Mr. DIXON. Mr. Chairman, thank you for the honor of appearing before you this morning. I am R. M. Dixon, chairman of the Texas Board of Water Engineers, at Austin, Tex. I don't intend to take your time but with your permission I would like to file my statement for the record and tell you that we heartily endorse the two projects. We think that they are workable.

Senator LAIRD. The statement is received and ordered filed.

(Mr. Dixon's prepared statement follows:)

STATEMENT OF R. M. DIXON, CHAIRMAN OF THE TEXAS BOARD OF WATER ENGINEERS, AUSTIN, TEX.

I am R. M. Dixon, chairman of the Texas Board of Water Engineers, Austin, Tex., appearing here in support of the above named projects. The board of water engineers has been designated by Gov. Allan Shivers as the State agency to review and prepare comments on reports concerning proposed water resources developments by Federal agencies that are submitted to him under provisions of the Flood Control Act of 1944. Secretary of the Interior McKay, by letter of May 27, 1955, transmitted to Governor Shivers the report by the Bureau of Reclamation on a proposed water salvage project on the Lake McMillan Delta, Pecos River Basin, N. Mex. Comments were prepared, and with the approval of Governor Shivers, transmitted to Secretary McKay. Those comments were in support of the proposed project.

The board of water engineers had previously received copies of the report on the Possible Improvement of Quality of Water of the Pecos River by Diversion of Brine at Malaga Bend, Eddy County, N. Mex., by the United States Geological Survey. This report, reproduced by the Pecos River Commission, along with the report of the Pecos River Commission on its action program, have both been reviewed by the Texas Board of Water Engineers, but no comments on these were considered as necessary.

The board of water engineers participated in the negotiation of the Pecos River compact, and since it has become effective (1949), the board has been vitally concerned with the administration of the compact by the Pecos River Commission.

The compact contemplates the salvage of Pecos River water now being nonbeneficially consumed by native vegetation, and the improvement of the quality of the river water. The Pecos River Commission in connection therewith has pursued a vigorous program, in cooperation with the interested Federal agencies, in amassing the data required for the planning of the two projects represented by the legislation before you. The commission's engineers can supply you with the detailed information on these projects.

It is my understanding that during the 4 irrigation seasons from 1951 through 1954, the water supply of the Red Bluff Water Power Control District was such that little or no water was available and no land was irrigated under that project from river water, although as much as 40,000 acres is irrigated in years of normal water supply. The small quantity of water available was rendered unusable by the high concentration of salt in the water entering Red Bluff Reservoir, with most of this salt being contributed to the river in the Malaga Bend area.

The current drought comprises the most severe period in the operation of this district. It is my understanding that the presently contemplated water salvage project, if it had been in operation prior to and during this dry period,

would have partially mitigated the effects of this drought. If the salinity alleviation project had also been in operation the water entering Red Bluff Reservoir would have been of a much better quality, although even then it would be considered poor in quality when compared to the water of the other river basins in Texas. If we can get the two proposed projects into operation, the combined result will be a firmer water supply than has been available in recent years, as well as providing water of a better quality.

I would like to call your attention to the fact that other areas in Texas have similar salt pollution problems, although none as severe as encountered on the Pecos River. Both the Brazos River Basin and the Red River Basin are so affected. The Brazos River Authority requested a copy of the Malaga Bend report immediately following its publication. Data obtained from this project at Malaga Bend will provide information to determine the effectiveness of the proposed method in reducing the brine inflow on the Salt Fork of the Brazos River above the Possum Kingdom Reservoir. There are other areas with similar problems that need similar attention and would profit if this program is initiated and its operation evaluated. It is believed that this project when put underway will be the first of this type ever established.

In view of the foregoing I concur in the statement in the report of the USGS that, "Although an action program which involves pumping of brine from the basal aquifer in the Malaga Bend area and storage of the brine in Queen Lake, appears to have a fair chance of success hydraulically, such a program should be considered as experimental."

On behalf of the Governor of Texas, I urge that you do what you can to provide relief from the aforementioned circumstances now existing on the Pecos River.

Mr. LINEWEAVER. Mr. Steve Reynolds, State engineer of New Mexico.

STATEMENT OF S. E. REYNOLDS, STATE ENGINEER AND SECRETARY, INTERSTATE STREAM COMMISSION OF THE STATE OF NEW MEXICO, SANTA FE, N. MEX.

Mr. REYNOLDS. My name is S. E. Reynolds. I am State engineer and secretary of the Interstate Stream Commission from the State of New Mexico. I have a prepared statement which I should like to have made a part of the record, and I would like to brief that statement if I may.

Senator LAIRD. Very well.

Mr. REYNOLDS. New Mexico believes that spur drains should be incorporated in the Bureau of Reclamation plan to the greatest extent economically feasible in order that the greatest amount of water possible can be salvaged. The States of New Mexico and Texas have agreed to share equitably the right-of-way, road and bridge relocation, operation and maintenance costs, including the costs of access road, in connection with the water salvage program.

The State's share of the construction costs has been estimated to be $288,700, and the annual operation and maintenance costs have been estimated to be $52,800. These costs would be borne 57 percent by the New Mexico and 43 percent by Texas, which is in proportion to each State's share of the salvage water.

Since the benefits of the salinity alleviation program accrue exclusively to water users in Texas, Texas will bear all of the right-of-way and operation and maintenance costs of that program.

New Mexico believes that the construction of both the water salvage and salinity alleviation programs are in the interest of the Federal Government and that it is necessary and proper that the Federal

Government's share of the construction costs be nonreimbursable for these reasons.

The Red Bluff and Carlsbad Irrigation District, which are the only readily identifiable beneficiaries of the program, owe the Federal Government $3.5 million of construction costs at this time. Their ability to meet these obligations has been adversely affected by the present conditions which led to nonbeneficial consumption and salt contamination of a water supply which is already drastically reduced by drought.

Even though these programs improve the water supply on the Pecos River, the water users will not be able to assume substantially greater obligations.

A water-salvage program similar to the one proposed for the Pecos River was constructed on the Rio Grande above Elephant Butte Reservoir largely with nonreimbursable funds, and that construction sets a precedent for the plan of financing the proposed plan here.

The salinity alleviation program is experimental in nature. The information gained in this program will provide benefits for water users throughout the United States where similar problems exist.

The State of New Mexico wishes to express its gratitude for the opportunity to be heard by this committee and to urge early and favorable action on legislation authorizing the water salvage and salinity alleviation program.

Senator LAIRD. Thank you, Mr. Reynolds.

(Mr. Reynolds' prepared statement follows:)

STATEMENT OF S. E. REYNOLDS, STATE ENGINEER AND SECRETARY OF THE INTERSTATE STREAM COMMISSION OF THE STATE OF NEW MEXICO

My name is S. E. Reynolds. I have been State engineer and secretary of the Interstate Stream Commission of the State of New Mexico since August 15, 1955.

There has been an inadequate supply of water for established uses in the Pecos River Basin in New Mexico and Texas for a number of years. The supply has been reduced by a combination of factors—drought, sedimentation, salt contamination, and salt cedar infestation—which the State and local interests are incapable of effectively combating. This water shortage has adversely affected the ability of the Carlsbad Irrigation District and the Red Bluff Water Power Control District to meet their obligations to repay current project construction costs to the Federal Government. The economy of the basin in New Mexico and Texas is based primarily on agriculture, and the water shortage also has adversely affected general business conditions in the area.

Article IV of the Pecos River compact, which was signed by the United States and the States of New Mexico and Texas in 1948, states in part (*a*) "New Mexico and Texas shall cooperate to support legislation for the authorization and construction of projects to eliminate nonbeneficial consumption of water." (*b*) "New Mexico and Texas shall cooperate with agencies of the United States to devise and effectuate means of alleviating the salinity conditions of the Pecos River." The Bureau of Reclamation report, dated November 1945, and entitled "Plan for McMillan Delta Water Salvage Channel, Pecos River Basin, N. Mex.," and the Geological Survey report, dated December 1954, and entitled "Possible Improvement of Quality of Water of the Pecos River by Diversion of Brine, Malaga Bend, N. Mex., describe parts of an overall program conceived by the Pecos River Commission during formulation of the compact to restore a part of the water supply formerly available to users in New Mexico and Texas.

The historical aspects of the problem, the physical features of the water salvage and salinity alleviation programs and the beneficial effects to be expected from these programs have been, or will be, adequately described in other testimony heard by this committee.

In reviewing the water salvage plan, New Mexico found it necessary to recommend that the authorizing legislation incorporate a proviso holding in abeyance the clearing of the floodway. This deferment is necessary to avoid accelerated siltation of McMillan Reservoir until some provision can be made to replace Carlsbad Irrigation District terminal storage capacity which might be lost by the clearing of the floodway. Agreement as to the necessity and the form of the proviso incorporated in Senate Joint Resolution 155 and House Joint Resolution 563 has been reached between the States of New Mexico and Texas and the local interests involved.

Studies are now being made by the Bureau of Reclamation and the Geological Survey to determine what provisions for the replacement of the Carlsbad terminal storage are practicable. The State of New Mexico feels that it is unnecessary and unwise to wait until these studies have been completed before authorization, final planning, and construction of the water salvage program are undertaken. While the maximum benefits are to be derived from the construction of the entire project as described in the Bureau of Reclamation's report, the project is economically feasible without a cleared floodway; the benefits derived will exceed costs even if it is necessary to operate the project without a cleared floodway for a number of years. It is possible that a solution to the terminal storage problem will be forthcoming by the time the conveyance channel has been completed and that the floodway can then be cleared without delay.

New Mexico has agreed to share equitably with Texas all right-of-way, road and bridge relocation and operation and maintenance costs of the water-salvage program including the cost of an access road. The States' share of the construction costs for the water-salvage program has been estimated at $288,700, and the operation and maintenance costs for the project have been estimated to be $52,800 per annum. New Mexico and Texas have agreed that all of these costs shall be borne 57 percent by New Mexico and 43 percent by Texas which is in proportion to each State's share of water salvaged. It is planned that local interests in New Mexico that are benefited by the program will bear the annual operation and maintenance costs.

Since the benefits of the salinity alleviation program accrue exclusively to water users in Texas, the State of Texas and local beneficiaries in Texas will bear all of the right-of-way and operation and maintenance costs of the salinity alleviation program.

New Mexico believes that construction of the water salvage and salinity alleviation projects is in the interest of the United States as a whole and that it is necessary and proper that a substantial amount of the construction costs of the water salvage and salinity alleviation programs be nonreimbursable for the following reasons:

(1) The Carlsbad Irrigation District and the Red Bluff Waterpower Control District, the only readily identifiable beneficiaries of the programs, owe the Federal Government a total of approximately $3,500,000 for construction costs at this time. The ability of the districts to meet their obligations is adversely affected by the existing conditions which result in nonbeneficial consumption and salt contamination of a water supply already drastically reduced by drought.

(2) Even though the present water supply is improved by the proposed programs the water users will not be able to assume substantially greater financial obligations.

(3) The records indicate that in 7 of the 49 years included in the period studied water would be spilled from Carlsbad Irrigation District and Red Bluff District reservoirs. In such years the water salvaged would not be usable by those districts but would be available for use by downstream appropriators in Texas who are not readily identified.

(4) A water-salvage program similar to the one recommended for the McMillan Delta on the Pecos River was constructed largely with nonreimbursable Federal funds on the Rio Grande above Elephant Butte Reservoir. This construction establishes a precedent for the method of financing proposed for the McMillan Delta water-salvage program.

(5) The salinity alleviation program is experimental in nature. From information gained in the program, benefits will accrue to water users throughout the United States where similar salinity problems exist.

The State of New Mexico takes this occasion to express its gratitude for the opportunity to be heard by this committee, and to strongly urge early and favorable action on legislation authorizing the water salvage and salinity alleviation programs on the Pecos River.

Mr. LINEWEAVER. The next witness is Judge Sturrock of Texas.

STATEMENT OF J. E. STURROCK, GENERAL MANAGER, TEXAS WATER CONSERVATION ASSOCIATION

Mr. STURROCK. Mr. Chairman, I filed a statement with the Interior and Insular Affairs Committee of the House, and I want to submit a similar statement to this committee for inclusion in the record, and I shall not take any more time of the committee.

I am J. E. Sturrock, general manager of the Texas Water Conservation Association. I am appearing here in behalf of my association and in support of Senate Joint Resolution 155.

Since Mr. J. C. Wilson, Pecos River Compact Commissioner of Texas and Mr. R. L. Lowry, its engineering adviser, are testifying, and also Mr. C. J. Anderson, general manager of the Red Bluff Water-power Control District, has or will testify as to the conditions on the Pecos River at McMillan Reservoir and below, and the benefits to be derived from the two projects, I shall not burden the record with any further testimony.

(Mr. Sturrock's prepared statement follows:)

STATEMENT OF J. E. STURROCK, GENERAL MANAGER, TEXAS WATER CONSERVATION ASSOCIATION, AUSTIN, TEX.

Mr. Chairman and members of the committee, my name is J. E. Sturrock. I am general manager of the Texas Water Conservation Association, a statewide organization incorporated under the laws of Texas and dedicated to the task of developing, conserving, controlling, protecting, and utilizing the water resources of Texas for all beneficial purposes.

I appear here in support of House Joint Resolution 563 which provides for the construction, upon a nonreimbursable basis, of a 1,500 cubic feet per second water salvage channel with spur drains sufficient to drain McMillan Delta in the Pecos Basin in New Mexico, in accordance with plans set forth in the report entitled "Plan for McMillan Delta Water Salvage Channel, Pecos River Basin, N. Mex.," prepared by the Bureau of Reclamation, and approved by the Secretary of the Interior, and dated November 1954.

House Joint Resolution 563 also provides for the construction, upon a nonreimbursable basis, of works for the alleviation of salinity in the Pecos River Basin, N. Mex., in accordance with the report entitled "Possible Improvement of Quality of Water of the Pecos River by Diversion of Brine, Malaga Bend, Eddy County, N. Mex." prepared by the Water Resources Division, Geological Survey, and dated December 1954.

The estimated cost of the water salvage channel in the Pecos River Basin is estimated at $2,161,000 and for the construction of works to alleviate salinity in such basin, cost is estimated at $150,000. Annual operation and maintenance cost for the channel will be approximately $52,800; for the salinity works $4,300.

The act provides for Texas and New Mexico to make substantial contributions to the cost of construction of such channel and salinity facilities, if the Federal Government joins in construction costs. Texas and New Mexico authorities have agreed to undertake equitably the financial burden of operating and maintaining the project.

These projects are of vital importance to Texas and New Mexico, and especially to Texas. There are now being irrigated, or subject to irrigation if water is available, more than 54,000 acres of land in Ward, Reeves, and Pecos Counties, Tex., from the Pecos River. The water users in said counties have voted bonds and taxing themselves to the limit to pay for the construction of the Red Bluff Reservoir which is located a short distance below the Texas-New Mexico State line. Most of the flow of the Pecos River originates in New Mexico in the form of storm and flood waters.

In 1949 Texas and New Mexico entered into a compact equitably dividing the waters of the Pecos River between the two States which was ratified by the legislatures of the respective States and by the Congress the same year. House Joint Resolution 563 will further implement the compact.

In a study of the Pecos River by the engineers of the Pecos River Compact Commission, it was estimated that if the more than 15,000 acres of saltcedar growing on the delta above McMillan Reservoir could be eradicated or bypassed by channeling, more than 40,000 acre-feet of water could be added to the Pecos.

In the Malaga Bend area near the State line is a formation, which retains under artesian pressure, and a salt solution having a concentration of some 150,000 parts per million. This brine contributes some 120,000 tons of salt per year directly into the limited supply of water which Texas receives from the Pecos River to irrigate the 54,000 acres of land above mentioned.

Mr. J. C. Wilson, of Pecos, Tex., Pecos River compact commissioner for Texas; Mr. A. J. Anderson, also of Pecos, general manager, Red Bluff Water Power Control District; Mr. Robert W. Lowry, consulting engineer, Austin, Tex., and engineering adviser to Mr. J. C. Wilson, and others, have testified as to the conditions in the Pecos River Basin and the benefits to be derived from the improvements provided under the provisions of House Joint Resolution 563. Therefore, I shall not burden the record of this hearing with further testimony on my part.

The Texas Water Conservation Association joins the other proponents of House Joint Resolution 563 in urging its passage by the Congress.

Mr. LINEWEAVER. Mr. Chairman, Mr. Robert W. Jennings, regional director of the Bureau of Reclamation, Amarillo, Tex., under whose jurisdiction this development comes, is here. Have you anything to add to what has been stated?

Mr. JENNINGS. I don't think so; thanks. I believe it has been pretty well covered.

Senator LAIRD. Mr. Lingle.

Mr. LINGLE. My name is Robert T. Lingle. I am director of the Pecos River Commission's action program.

As you know, the Pecos River Basin has for many years had an inadequate water supply. The deteriorated channel condition above Lake McMillan Reservoir is depriving water users of a large part of this already inadequate water supply. The encroachment of salt cedars has aggravated the condition to the extent that only a small percentage of the normal river flow and releases from Alamogordo Reservoir are reaching the irrigated areas.

In this area the river channel is so completely choked with salt cedars that there is little semblance of a defined watercourse. River water spreads over a large area of the delta and builds up the deposits of sediment which are ideal rooting areas for salt cedars. Ponds are created and water is lost through evaporation, deep percolation, and transpiration from the ever-increasing vegetation.

Continuation of channel deterioration and salt cedar encroachment will finally result in abandonment of lands in New Mexico and Texas which are now irrigated, and extinguishment of the civilization dependent upon that irrigation. The repayment ability of the beneficiaries of large Federal investments in such works as the Carlsbad irrigation project and Alamogordo and Red Bluff Dams will be lost.

Poor quality of water is another troublesome and equally serious problem in the Pecos River Basin. Contributing to the poor quality is the contribution of about a half cubic foot per second of brine which brings 370 tons of pure salt to the river daily through seeps and springs along a 3-mile stretch at Malaga Bend in New Mexico just above where the river empties into Red Bluff Reservoir in Texas. The commission, in cooperation with the United States Geological Survey, has devised a plan which it is estimated will eliminate approximately 75 percent of this salt contribution to the river.

In 1953, when the inflow to Red Bluff Reservoir decreased, the mineral or salt concentration heavily increased, thereby making the water unfit for irrigation. Where the water had been applied to the land it actually killed the crops with the result that no land was successfully irrigated within the Red Bluff district in 1953. The consequences of this catastrophe were staggering. Therefore, in the judgment of the commission, a water salvage program for the Pecos River is imperative.

The fact that the salt cedar growth commenced in the delta area above Lake McMillan during the time the Bureau of Reclamation operated the Carlsbad project, and was permitted to grow and spread unabatedly, consuming approximately 5 acre-feet of water per acre annually of an already dwindling water supply, makes one feel that there is a Federal responsibility involved. Furthermore, of the approximately 13,000 acres of salt cedars in the delta area, approximately 6,500 acres, or 50 percent, are on Government-owned lands, consuming, when a full water supply is available, approximately 32,500 acre-feet of water or about the capacity of Lake McMillan Reservoir.

The commisison feels that the national interest is such that all costs except those hereinafter enumerated should be nonreimbursable. A precedent has been established for full Federal participation in a water salvage project by the construction of a conveyance channel and floodway, similar to the one recommended, on the main stem of the Rio Grande above Elephant Butte Reservoir in New Mexico. In October 1951, the Bureau of Reclamation let a contract for about 30 miles of channelization work extending from the narrows to San Marcial. It was completed in 1953. The second contract, providing for 9 miles of channelization from San Marcial to the heading near Point of Land at the southern boundary of the Bosque del Apache Fish and Wildlife Refuge, was started in November 1952 and completed in May 1954.

The cost of the 39 miles of channel was $3,148,263, all of which was nonreimbursable. Furthermore, the Federal Government maintains this channel at a cost of approximately $116,058 per annum. This channel has salvaged, since the commencement of construction through 1955, 165,000 acre-feet of water, which has done much toward improving irrigation conditions in the lower valley.

The proposed channelization on the Pecos will cost an estimated $2,161,000 of which the States of New Mexico and Texas will contribute $289,000 in the way of rights-of-way road and bridge changes and one access road. The States will jointly operate and maintain the project at no expense to the Federal Government.

The salinity alleviation project will cost the Government $150,000. The States will contribute the rights-of-way for pipelines and the disposal area for brine, and the maintenance and operation will be borne by the Red Bluff Water Power Control District.

Not ony will the salvage channel reclaim approximately 24,000 acre-feet of water per annum, and the salinity alleviation program insure a better quality of water to the Red Bluff area, but the latter program will be a means of furnishing invaluable information to other areas that have a similar salinity problem.

The Carlsbad Irrigation District and the Red Bluff Water Power Control District whose reservoirs were constructed by Federal funds

and who still owe the Government about $1,700,000 each, have water supply problems which are due in part to decreasing runoff, in part to flood and sedimentation problems long recognized as a Federal responsibility, and to drought, salt cedar infestation, and other factors of an emergency nature beyond the ability of local interests to correct.

The construction of the recommended projects will not only stabilize the economy of the irrigated area affected but will do much toward strengthening the economic structure of the two States and Nation.

Senator LAIRD. Is there anyone else present who has a statement to make?

The record will remain open for several days for the purpose of permitting any further statements.

The hearing is now recessed until further call of the Chair.

(Whereupon, at 11:50 a. m., the committee was recessed subject to call.)

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